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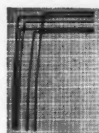
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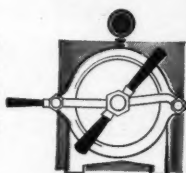
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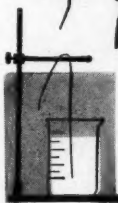
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With Emphasis on Procedures in Trauma

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THE AMERICAN SURGEON

Vol. 19, No. 4

April, 1953

MALIGNANT MELANOMA

JOSEPH P. McNEILL, M.D., JOHN V. GOODE, M.D.

Dallas, Texas

AND ANTON CAROE, M.D.

Nashville, Tennessee

Malignant melanomas have certain unusual characteristics of growth and spread which set them apart from other malignant tumors. It is possible that a careful study and evaluation of these characteristics will lead to a solution of the problem of their treatment.

The probable etiology of melanomas has been adequately discussed elsewhere and will not be considered here other than to mention the fact that it is now generally realized that a pigmented nevus, a precursor of malignant melanoma, probably represent a philogenetic stage in the evolution of the tactile pigmented spots of reptiles into the hair follicles of the mammal. There is some evidence to indicate that malignant melanoma is really a systemic disease. (Although surgical treatment, at present, offers by far the best prognosis, it is not the final solution of the problem as attested by the high mortality figures reported throughout the literature^{1, 2}.)

The fact that malignant melanomas, developing in pregnant women, are almost universally fatal; the fact that prepuberty malignant melanomas never metastasize; the fact that histological characteristics have little bearing on prognosis; and finally, the fact that cases of spontaneous remission of the disease have frequently been reported, all demonstrate that there are unusual systemic factors, possibly hormonal, effecting the growth and spread of these tumors.

This report, a study of 37 patients seen in private practice, is presented, not

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because of any statistical importance, but rather to demonstrate some of the unusual growth characteristics of melanomas and to consider some of the problems in their treatment. To illustrate some of these unusual characteristics, the following 4 cases, taken from our reported group, are presented.

Case 1. Mrs. G. W. B., 71 year old white woman.

October 1943. Pigmented nevus removed from anterior surface of left thigh. Pathologist reported *benign melanoma*.

August 1944. Patient returned with large left inguinal and iliac nodes. Inguinal node removed for biopsy and reported to be "metastatic malignant melanoma." Pathologist changed diagnosis of original biopsy to malignant melanoma after restudying slides.

Comment. This patient's record is presented to show that the microscopic diagnosis of malignant melanoma can be extremely difficult even by a competent pathologist. The far advanced lesion is, of course, not a diagnostic problem for either the clinician or the pathologist. The record of this patient shows that utmost care, diligence, and perseverance by the pathologist should be exercised to arrive at an accurate diagnosis in an early case. This patient would have been ideal for an *in-continuity* gland resection and could possibly have been salvaged by such a procedure had the microscopic diagnosis been accurate on the first examination. At the second examination her chance for a cure was lost. The difficulty in making a microscopic diagnosis in these cases makes it unwise to charge the pathologist with the responsibility of making a diagnosis from a frozen section. Excision biopsy specimen and permanent section examination is a more judicious plan of action than staking all on a frozen section examination.

This record is an example of rapid growth of malignant melanoma in the aged; it is also an example of a rapidly growing tumor which microscopically showed only the lowest grade of malignancy.

Case 2. Mr. J. R. S., 25 year old white man.

July 1943. Injured small pigmented mole over left scapular area. The lesion failed to heal.

November 1943. Wide excision and skin graft.

July 1945. Axillary mass removed.

February 1946. Another axillary mass removed.

June 1946. More axillary nodes removed.

July 1946. Wide axillary dissection.

December 1946. Axillary nodule excised.

March 1947. Axillary nodule excised.

July 1947. Interscapulothoracic amputation.

August 1952. Follow-up examination revealed no evidence of recurrence.

Comment. Although this patient was obviously injudiciously treated, it does illustrate, in a comparatively young person, the presence of the tumor in the regional lymphatics for a long period of time, notwithstanding meddlesome and incomplete surgery. Conservative *picking* at a malignant lesion is mentioned only to be condemned. This patient is alive nine years after developing his initial lesion, and five years without evidence of recurrence after his *fore-quarter* resection.

Case 3. Mr. L. W. P., 40 year old white man.

October 1943. Pigmented mole burned from right scapular region.

February 1944. Herpes zoster in this region.

February 1945. Noticed lump in right axilla.

October 1945. Axillary gland resection (original scar not disturbed). Gland mass 5 by 4 by 4 cm. Biopsy specimen reported to be malignant melanoma.

August 1952. No evidence of recurrence on follow-up examination.

Comment. This report demonstrates a good result, a nine year arrest, in a patient who had a radical resection of the regional glands without a block *in-continuity* resection of the original scar and intervening lymphatics. It also raises the question of whether the herpes zoster, which he developed in the region of the initial lesion, could have played a role in the favorable outcome. Perhaps this substantiates Pack's^{3, 4, 5} report that rabies vaccine might have been responsible for a remission in one of his cases of malignant melanoma.

Case 4. Mrs. M. V. D., 70 year old white woman.

March 1948. Ulcerating lesion developed on plantar surface of left foot.

September 1948. Wide excision and skin graft. Biopsy specimen reported to be malignant melanoma.

January 1950. Recurrent ulceration at margin of skin graft. Ulcerating pigmented satellite nodules on medial aspect of left thigh and a 4 by 6 cm. node in the left groin. Patient refused operation.

October 1950. Patient visited *faith healer* in Oklahoma. Ulcerating areas healed promptly and the node disappeared.

July 1952. Primary site healed. Ulcerated areas on inner aspect of thigh healed with white scars surrounding three small pigmented satellite nodules. No nodes were palpable.

Comment. This remarkable case, which represents a spontaneous remission of the disease, illustrates that there are systemic factors that as yet have not been explained. One would suspect some hormone, or hormone-like factor, responsible for such a remission.

TREATMENT

A discussion of the treatment of malignant melanomas should be prefaced by a few remarks concerning prophylactic therapy. It is impossible and impractical to remove all pigmented nevi; however, any hairless, smooth, slightly raised lesion that begins to grow; exhibits an increase in pigmentation; is subject to irritation; that bleeds easily, or becomes ulcerated should be removed surgically with a wide margin of safety. Pigmented nevi of the external genitalia, subungual areas, palms, and soles of the feet should also be removed.

Malignant melanomas developing during pregnancy produce an extremely bad prognosis; for this reason, part of the prenatal examination should include a survey of the patient's pigmented nevi.

Prophylactic treatment of pigmented nevi, which are being removed for cosmetic reasons, or because they are in areas subject to constant irritation, should include a survey of the entire skin areas for more suspicious lesions and a search for palpable lymph nodes. A careful record of this examination is imperative for future reference. It is important to emphasize that, after prophylactic removal

of pigmented nevi, a thorough microscopic examination should be made of the tissue removed, and careful notation made of the sites of removal if several moles are excised at one operation.

Surgical excision of melanomas should be made with at least 2 millimeters of skin margin in addition to the subcutaneous fat. We have had no experience in the treatment of melanomas with cauterization, electrodesiccation, or irradiation.

Lesions showing the clinical characteristics of malignant degeneration should be treated much more radically. Such lesions on the trunk must be excised widely with a margin of several centimeters on each side, including a still wide area of the subcutaneous fat and deep fascia. The resulting wound is so large that we always employ a skin graft for closure. Local excision is probably the preferable treatment for lesions in other areas, such as the head, neck, hands or feet. A radical secondary procedure should be done if the pathologist's report is malignant melanoma. Mutilating operations cannot be justified without positive microscopic diagnosis.

The more radical procedures must be fitted to the patient. In general, one is more conservative in the aged and poor-risk patient. Perhaps it is better to terminate treatment with the local excision and let the disease run its course, because partial removal of a malignant melanoma, at times, seems to increase its rate of growth; however, most cases will lend themselves to further treatment if distant metastases are not present.

For lesions of the head and neck an *in-continuity* resection can be planned to include not only a wide removal of the old scar but also a radical excision of the cervical lymph nodes on the affected side. Lesions of the scalp always require skin grafting.

For the trunk, a primary wide excision with skin grafting should be the first procedure. Usually it is impossible to plan an *in-continuity* excision unless the lesion happens to be located near one of the regional groups of nodes. For example, a malignant melanoma located near the scapula can metastasize either to the cervical nodes, or to the axillary nodes on the same side, or to both sides if it is near the midline. When the operation cannot be planned to include all groups of nodes, it seems wiser to wait until the tumor shows to which group it will metastasize and then radically remove that group. If blood stream metastases occur, the patient is lost.

Notwithstanding the fact that a subungual malignant melanoma is often quite small, it justifies amputation of the digit as the first operation. After amputation of a toe or finger for subungual malignant melanoma, we believe that there should be a delay to determine the progress of the tumor. If axillary or inguinal glands develop, which are proved to be malignant by biopsy, one is faced with advising either a radical gland resection or the very radical interscapulothoracic amputation or hemipelvectomy. This is a very serious decision which frequently reaches out into the realm of philosophy. Certainly some poor-risk or very aged patients cannot be subjected to such a *fore-quarter* or *hind-quarter* amputation. It should be offered to those who can tolerate the operation, with the frank explanation that it will increase their chances of survival by only 3 to 5 per cent. Many

patients will not accept such radical surgery; for them radical resection of the regional glands is a slightly less satisfactory alternative, but still offers more than local excision alone.

Lesions on the sole of the foot should have wide local excision and skin grafting. A satisfactory covering can be obtained with split-thickness skin providing the weight bearing surfaces can be saved. Pedicle flaps must be used when the weight bearing surfaces are sacrificed. Secondary procedures for foot lesions can be planned, using the same principles as outlined for lesions of the toes and fingers.

If a melanoma removed from a child before puberty is reported to be malignant, it is not nearly as serious as if the lesion had occurred in an adult. Melanomas of childhood, which look exactly like the melanomas of adult life, rarely metastasize. In fact it is probable that these tumors are not really malignant, and as previously mentioned, are the result of some hormonal imbalance.

The principles of treatment as outlined were followed in the treatment of most of the 37 cases presented in this report. Two were so far advanced that no treatment other than local excision was possible. Twenty-seven of the remaining 35 patients have been observed for three or more years. Ten patients are known to have survived three or more years; of these, 8 had positive nodes. Eight patients have survived five or more years and 6 of these had positive nodes.

SUMMARY

Growth characteristics and problems in the treatment of malignant melanoma are discussed, based on an analysis of 37 patients with this disease seen in private practice.

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THE PROBLEM OF WOUND DISRUPTION

H. MAX SCHIEBEL, M.D. AND BENNETT CREECH, M.D.

Durham, N. C.

In recent years many serious postoperative complications of surgery have been successfully attacked and virtually eliminated. Wound disruption, however, continues to present a problem which has defied complete and conclusive solution. This complication is relatively uncommon. The incidence is variously reported as 0.2 per cent to 3 per cent. When this catastrophe occurs, the accompanying distress to the patient, the patient's family and to the surgeon, is extreme, being surpassed perhaps only by that following acute pulmonary embolism and infarction. The mortality of wound disruption has been greatly lowered by the use of blood transfusions, antibiotics and other modern therapy.

Pathologic Physiology of Wound Healing. In the healing of any wound, the manner in which the repair occurs depends upon the patient, the character of the wound, the suture material, and the surgical technic. Patients with healthy tissues heal well. Wound healing is a process of reaction to injury, and demonstrates the usual pathologic physiology seen in cases of repair following any trauma. In the first or *lag* period of healing, inflammation and exudation are present. This period lasts for four or five days; the wound is weakest during this time. The second or regenerative period is characterized by fibroplasia and lasts from the fifth to the tenth or twelfth postoperative day. The strength of a well-sutured wound is only 40 per cent of that of the uncut tissues. If absorbable sutures are used, the tensile strength drops to 20 per cent to 25 per cent of the original strength. The wound has regained 50 per cent of its strength by the sixth day and 90 per cent by the tenth postoperative day.⁴

In order for normal wound healing to occur, certain major optimum conditions must exist:

1. Adequate available protein and a positive nitrogen balance must be present in the tissues. Protein is the principal building constituent. When the normal relation between intravascular and extravascular fluid is maintained by normal colloid osmotic pressure, protein will be available for use in healing. Serum protein levels, although of some value, are not true criteria of nitrogen metabolism. Weight loss is a better index.

2. Sufficient ascorbic acid must be available to form collagen (and other intercellular materials) and new capillaries. Experimental evidence indicates that pyridoxine and riboflavin are also involved in wound healing.⁵

3. The peritoneum and other layers must be accurately closed.

4. Infection must be absent.

5. Normal intra-abdominal pressure must be maintained as nearly as possible.

Etiology. Numerous factors, some of great importance and others worthy only of mention, are listed in the literature as contributing to the onset of wound

From the Department of Surgery, Watts Hospital, Durham, North Carolina.

disruption. The basic difficulty in separation of wounds is, of course, delayed wound healing. Whether or not an abdominal wound disrupts depends upon: 1. the patient, 2. the wound, 3. the surgical technic and 4. the postoperative course.

1. *The Patient.* When a relatively healthy patient is subjected to abdominal surgery, satisfactory wound healing usually occurs. When existing disease produces or is superimposed upon protein deficiency, deficiencies of ascorbic acid (and in some cases, low levels of riboflavin and pyridoxine), chronic anemia from any cause, infection, associated respiratory disease with cough, jaundice, arteriosclerosis, diabetes or obesity, normal tissue repair is retarded. A protein deficient patient is more susceptible to infection. Local edema, due either to excessive trauma or to low protein levels, is an important factor. In patients with prolonged fever, intestinal fistula, prolonged diarrhea or intestinal obstruction, the ensuing dehydration may further delay wound healing. Although cancer *per se* does not produce failure of wound healing, separation is more frequent in patients who have cancer, because many of the above factors are present in and associated with malignant disease.

Disruptions may occur in well-nourished patients, and some patients who have very poor nutrition heal without difficulty. It may be concluded that in the latter a less potent precipitating cause is necessary to bring about dehiscence.

2. *The Wound.* It has been stated by numerous authors that disruption is essentially a complication of the vertical incision. Certainly the incidence is higher in such wounds, but no wound, transverse or otherwise, will hold if the intra-abdominal pressure is increased to the point when the strength of the healing tissue is overcome. Wounds in the upper abdomen, and muscle-cutting rather than muscle-retracting incisions, are more apt to disrupt than others.

Operations for lesions of the colon are the most frequent offenders as far as evisceration is concerned. The incidence of disruption in these wounds is 12 times the average; operations upon the stomach, duodenum and biliary tract are a close second with $5\frac{1}{2}$ times the general average.⁴

3. *Surgical Technic.* Prompt wound healing is facilitated greatly when there is a minimum of necrotic residue, bacterial contamination and foreign material. Poor wound draping, excessive strangulation of tissue by ligatures and the use of large, heavy suture material, all predispose to poor wound healing.

4. *The Postoperative Course.* It is obvious that the period following the operation is very important in assuring a well healed wound. Atelectasis and subsequent coughing, vomiting and distension increase the stress on the wound.

A widespread use of some of the new therapeutic agents in medicine and surgery has stimulated interest in the effect of these agents on wound healing. Howes and his colleagues³ found that cortisone retards the formation of granulation tissue and slows epithelization. They demonstrated that fibrin forms on the surface of the cortisone-treated wound, but does not act as a scaffold for the growth of granulation tissue and is not converted to collagen directly. Taylor and Ziperman¹⁰ showed experimentally that dicumarol has no effect on wound healing unless the prothrombin time drops to 10 per cent of normal or less.

Heparin, according to Bendix and Necheles¹ has no effect on the healing of wounds.

Diagnosis. Wound disruption is said to occur more frequently in patients in the older age group, but the *average* age in which this complication occurs is 44 years⁷. It occurs more frequently in males and more often in white patients than in Negroes. Dehiscence usually takes place between the fifth and tenth postoperative days.

Separation of the wound is usually the tragic climax of the postoperative course of the patient who has had a poor recovery from the start: the patient who has complained of excessive pain, who has been nauseated and has vomited frequently and persistently. He often becomes distended and requires intragastric suction, and may actually develop intestinal obstruction. In many cases the patient may have a prolonged unexplained low grade fever. Sometimes diarrhea occurs. In other patients, infected wounds develop. Most infected wounds will heal with proper treatment. In a few, however, the superficial portions of the wound are separated and an abrupt movement or increase in the intra-abdominal pressure causes the peritoneal layer to separate with eventual completion of disruption.⁶

Occasionally, after an apparently uneventful postoperative course, the sutures having been removed, the patient suddenly feels something give way or *snap*. Examination reveals dehiscence. On physical examination the pathognomonic sign is profuse drainage of a salmon-colored serosanguinous fluid from the wound, accompanied by an odor resembling that of fresh meat. If separation is incomplete, the edges of the fascia or a loop of intestine may be palpated in the wound while the dermal sutures are in place.

If a complete disruption occurs suddenly, the patient may develop a state of profound shock and, if proper treatment is not carried out immediately, he may die.

Prophylaxis. If the incidence and mortality of this complication of surgery are to be reduced, there are numerous basic principles which must be borne in mind during the three phases of management.

Preoperatively, it is important to evaluate the state of nutrition of the patient. A careful dietary history may reveal an inadequate food intake. If depletion of the tissue proteins is present, with or without hypoproteinemia, this defect should be corrected. This may be done by ingestion of protein by mouth, by intravenous injection of plasma, fractionated albumin or amino acids, or, when indicated, transfusions of whole blood. Elman⁷ has found that for every gram increase in the plasma protein, about 25 grams must be supplied for other protein needs. The transition from a negative to a positive protein balance proceeds slowly. Under ideal conditions, with the ingestion of 200 grams of protein per day, 10 to 14 days may be required for this transition. Lund⁸ recommends the administration of ascorbic acid, thiamin and niacin daily for four days before and after operation.

Any alteration of fluid and electrolyte balance must be corrected. If diabetes is present it must be adequately regulated. Obesity should be reduced before subjecting a patient to abdominal surgery.

At operation, tissues should be handled gently and hemostasis should be carefully maintained. The use of fine suture material, small needles and instruments produces less trauma, less tissue reaction, and promotes better healing. Wound edges should be protected from contamination and dehydration during an operation. One of the most common errors is tying sutures too tightly; the resulting tissue necrosis prolongs the lag phase of healing, the sutures cut through and the wound edges separate. Detached tissue can be removed by irrigating the wound with saline before closure of the outer layers.¹²

The technic of usage of suture material seems to be more important than whether or not the material is absorbable. Mixing both types of suture in the same layer is to be deplored, because the serum exuded in the reaction to catgut may become a culture medium for bacteria which invade the nonabsorbable suture and produce foci of infection. The most important single step in the closure of an abdominal wound is suture of the peritoneum. For this purpose interrupted everting stitches are best. If a continuous stitch is used, it is wise to supplement this with supporting interrupted sutures. Surgical catgut should be moist but not softened by soaking. The optimum temperature of all solutions used to moisten the suture material, sponges or laparotomy pads is approximately that of the body. Drains should be brought out through adjacent stab wounds. Retention sutures may be used if deemed necessary. These retention sutures may not prevent wound disruption, but will protect against evisceration.¹² Accurate closure is the most important preventive of wound separation. Walton¹¹ believes that the use of stainless steel wire helps to prevent dehiscence. He advocates the use of wire in all patients who have an acute intra-abdominal infection, malignancy, chronic debilitating disease or obesity. He also uses wire routinely in the aged patients.

Good anaesthesia is imperative during the time of closure of the wound and until all of the necessary sutures are in place. The employment of anatomic incisions, when adequate exposure is afforded through them, will result in better wound healing.

In the postoperative period, preventive care should begin while the patient is still on the operating table. The removal of endotracheal tubes without inducing coughing is an important preventive measure. The use of deep breathing exercises and carbon dioxide-oxygen inhalations during the first postoperative day helps prevent atelectasis; if atelectasis occurs, coughing should be encouraged with the abdomen supported.⁹ A scultetus binder is a useful adjunct in supporting the wound. If nausea or vomiting develop, early application of gastric suction will help avoid gastrointestinal distension, and increased intra-abdominal pressure.

Early ambulation, properly supervised, does not jeopardize the integrity of the operative wound. On the contrary, Burch and Bradley² found that healing may actually be improved by early ambulation, since it decreases the incidence of the above-mentioned postoperative complications. The ambulatory patient also is usually in a better nutritional state than the recumbent one.

Treatment. When dehiscence is discovered, any eviscerated bowel should be covered with a sterile dressing and the abdomen taped to prevent further dis-

ruption. Morphine is given to relieve apprehension, intravenous glucose is started, and a gastric suction tube is inserted. The stomach is aspirated and the tube is left in place. If indicated before or during operation, transfusions of whole blood are given.

The treatment of choice, when possible, is immediate resuture of the wound. The patient, whose condition will tolerate anesthesia and operation, is transported to the operating room in his bed. Collection of a specimen from the wound for culture is advisable. Mayo and Lee,⁹ advocate closure in layers if the patient's condition is good and the tissues are not too friable. When this seems unwise, the use of through and through sutures of wire or silk-worm gut is justified. These sutures should be closely spaced. Small rubber drains are placed in the upper and lower angles of the wound.

Local anesthesia is widely used as the anesthetic of choice for a secondary wound closure, but Mayo and Lee⁹ recommend pentothal and curare. Mason and Zintel favor the use of a spinal anesthetic unless this is contraindicated.⁶

TABLE 1*
Data on wound disruptions

	New York Hospital	Cleveland Clinic	Mt. Sinai Hospital	Barnes Hospital
Laparotomies.....	6,417	4,154	2,750	5,731
Total Eviscerations.....	43	44	26	47
Incidence, %.....	0.66	1.05	0.9	0.82
Deaths.....	14	15	7	16
Mortality Rate, %.....	30.2	34	29	34

* From Walton, R. E., Prevention and treatment of wound dehiscence, *Archives of Surgery* 57: 217-226 (Aug.) 1948.

Following the secondary closure, blood and amino acids should be given as indicated. Ascorbic acid (1 gram) and vitamin B complex should be administered daily. Intra gastric suction should be employed routinely as temporary ileus frequently ensues. Oxygen should be administered daily if deemed necessary. Early ambulation is advised. Parenteral injections of penicillin or other antibiotics should be used until oral medication is possible. Measures to prevent pulmonary complications are started immediately after operation. The drains are removed in 48 hours. Sutures are left in for 14 to 21 days.

If the condition of the patient is so poor that any surgery is contraindicated, the bowel should be replaced into the peritoneal cavity aseptically, the skin should be cleansed with ether and an antiseptic and flamed adhesive tape should be crisscrossed to bring the wound edges together. Supportive measures are then carried out as already outlined. Delayed suture may be done when the patient's condition permits. Prolonged hospitalization is frequently unnecessary but it is essential that the wire sutures remain in place for 3 weeks, in order to prevent a second disruption. This complication is, however, extremely rare.

After healing is complete approximately one-third of the patients who have

TABLE 2

Wound descriptions at the Watts Hospital, Durham, North Carolina, 1941 to 1951

Case No.	Operation	Age	Time of Secondary Closure After Disruption	Infection	Associated Conditions	Mortality
1	Laparotomy. Gastroenterostomy	44	Same day	No	Carcinoma neck of pancreas. Bronchopneumonia. Cong. Heart Failure	Yes
2	Laparotomy, Exc. Meckel's Diverticulum	60	Following day	Negative Culture	Intestinal Obstruction	No
3	Cholecystectomy. Subcostal Incision	55	Same day	Yes	Retching Postoperatively. Bronchopneumonia. Non-thrombocytopenic purpura (allergy)	No No
4	Cholecystectomy	53	Same day	No	Coughing Postoperatively	No
5	Appendectomy. McBurney Inc.	35	8 days later	Yes	Infection—Abscess of Wound	No
6	Closure perforated duodenal ulcer	33	7 days later	No	Perforated Ulcer	No
7	Cholecystectomy	58	Same day	No	Distension—Vomiting. Upper respiratory infection with cough	No
8	Dilatation & Curettage, Bilateral Salpingectomy. Appendectomy	30	Same day	No (Hematoma present)	Acute appendicitis. Incomplete abortion. Secondary anemia	No
9	Cholecystectomy	69	Same day	No	Chronic cholecystitis & cholelithiasis. Pernicious anemia	No
10	Lysis of peritoneal adhesions	5*	Same day	Yes, after 2nd closure	Intestinal obstruction. Postoperative distention	No
11	Exploratory Laparotomy	46	Same day	Not definite	Acute pancreatitis	No
12	Gastric Resection	75	Same day	No	Carcinoma of stomach. Subdiaphragmic abscess	Yes
13	Exploratory Laparotomy. Gastroenterostomy	67	Same day	No	Neurogenic sarcoma metastatic to omentum	Yes
14	Appendectomy	31	Same day	No	Obesity—acute appendicitis, generalized peritonitis	Yes
15	Resection of Sigmoid colon	47	Same day	No	Diverticulitis of sigmoid colon. Postoperative retching	No
16	Hysterectomy	29	Same day	No	Chronic cervicitis, endometritis, bronchopneumonia postoperative	No

TABLE 2—Cont.

Case No.	Operation	Age	Time of Secondary Closure After Disruption	Infection	Associated Conditions	Mortality
17	Colon resection for carcinoma	72	Same day	No	Postoperative atelectasis with cough	No
18	Hysterectomy	35	3 days	Yes	Wound infection	No
19	Ruptured duodenal ulcer	30	Same day	Yes	Postoperative peritonitis and distension bilateral pleural effusion	No
20	Ruptured appendix with right rectus incision	31	Same day	Yes	General peritonitis	No
21	Cholecystectomy	42	Same day	Yes	Diabetes	No
22	Stab wound of abdomen	49	Same day	No	Hemorrhage, peritonitis sterile with paralytic ileus	Yes
23	Traumatic rupture of ileum	30	Same day	No	General peritonitis with distension	No

*Weeks.

had wound disruption will have a ventral hernia. Repair of this should be delayed for 6 to 12 months, since the tissues may be friable and difficult to handle in the earlier stages.

Mortality. The average mortality rate of reported cases of wound disruption is 35 per cent. At the Mayo Clinic, from 1925 to 1929, the mortality rate was 34.1 per cent. In the period from 1945 to 1949, by the use of new anesthetics, antibiotics, blood transfusions, gastric suction and an improved control of fluid and electrolyte balance, the mortality rate was reduced to 18.1 per cent.⁹ Jergenson and Smith,⁴ in a study of 97 cases occurring from 1936 to 1946 reported a mortality rate of 43.8 per cent. Wolff, in his series of 45 cases, reported a mortality rate of 11.1 per cent.⁷

Walton¹¹ presented data on the mortality rate at 4 different hospitals and found it to vary from 29 per cent to 34 per cent (Table 1).

In our series of 23 cases at Watts Hospital during the period from 1941 to 1951, the mortality rate was 21 per cent (Table 2).

COMMENT

The operations in this series of cases were performed by several surgeons in a Community Hospital of 225 beds. Though there were minor variations, the technique of wound closure was usually the same, with the use of continuous surgical catgut in the peritoneum, and interrupted sutures of cotton or silk in the fascial layer.

The greatest number of disruptions followed cholecystectomy (25 per cent). Three disruptions followed appendectomies (13 per cent). Malignancy was present in 3 cases (13 per cent). Anemia was found in 2 cases and obesity in 1. Intestinal obstruction and/or abdominal distension complicated 8 cases (34 per cent). Retching or coughing postoperatively was a definite factor in causing disruption

in 8 cases (34 per cent). There were two operations upon the colon. Infection, statistically, was not important.

The ages of these 23 patients ranged from 5 weeks to 75 years, with an average age of 46 years.

Five of the 23 patients died (21 per cent). All 5 of these had secondary closure on the day the wound disrupted. The time of secondary closure seemed to have little influence on the mortality.

It should be emphasized that, in interpreting the mortality rate in this series of cases, the primary cause of death was malignant disease in 3 cases, although wound disruption was undoubtedly a factor. In 1 case the disruption, in addition to peritonitis, caused death.

The mortality rate is highest after colon operations, and in patients with cancer. There is no appreciable difference in the mortality rate in cases in which resuture is done within 24 hours and in delayed suture.⁹ The chief causes of death are pneumonia and peritonitis, but pulmonary and myocardial infarction are found in some patients who come to autopsy.

SUMMARY

1. The pathologic physiology of wound healing has been reviewed.
2. The etiologic factors in wound disruption have been discussed. It is emphasized that the most important of these factors are delayed wound healing and increased intra-abdominal pressure postoperatively.
3. The diagnosis of wound disruption is reviewed.
4. The prophylactic management before, during and following abdominal surgery is presented.
5. The treatment of the patient with wound disruption is described.
6. The mortality rate is considered, with emphasis on the lower mortality rate due to improved modern, preoperative and postoperative care.

Twenty-three cases of wound disruption at Watts Hospital are reported with a mortality rate of 21 per cent.

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A NEW TECHNIC OF COMBINING THORACOPLASTY WITH PULMONARY RESECTION

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During the past decade, the increasing employment of pulmonary resection in the treatment of bronchopulmonary disorders has tended to focus attention upon the hazards created by over-distention of the remaining pulmonary tissue. Gaensler and Strieder³ clearly demonstrated that postoperative emphysema and respiratory invalidism tend to follow pneumonectomy in many cases. These authors also summarized various methods used in preventing or combating pulmonary over-distention following complete resection. Conklin, Tuhy and Grismer¹ stated that over-distended lungs are considered to function with impaired efficiency, and suggested that any residual tuberculous lesions are more likely to manifest reactivation if over-distention develops. Other authors⁶ have suggested that reports of unfavorable late results in the early series of resections for pulmonary tuberculosis was directly dependent upon the factor of over-distention with activation of pre-existing tuberculous foci. Various space-filling materials (air, oil, lucite spheres, plastic sponge and hollow plastic prostheses) have been used in the pleural cavity to prevent over-distention following pneumonectomy. The use of such materials in cases of partial resection does not seem practicable, though it has been suggested that a plastic sponge be used as a prosthesis, and introduced intra or extrapleurally immediately following lobectomy.⁴ It has been shown that many of the problems resulting from pulmonary over-distention and mediastinal distortion cannot be solved by correction after such conditions have begun to develop. These changes *must* be anticipated and prevented if they are to be successfully combatted.

The use of a natural tissue barrier, to prevent over-distention and to obliterate the dead space created by resection, is surgically much more acceptable than the use of artificial substances or prosthetic materials. Concomitant thoracoplasty and resection appear to be the most satisfactory answer to the problem. The combined procedure is not without precedence. For example: the historic resection for carcinoma of the lung performed by Evarts Graham in 1933 was accompanied by a seven rib thoracoplasty. Cournand and Berry² were among the first to suggest that thoracoplasty might be used to prevent pulmonary over-distention and to preserve maximal ventilatory function. Iverson and Skinner⁵ in 1949, advocated the use of thoracoplasty combined with pneumonectomy, and Samson⁸ in 1950, employed concomitant thoracoplasty in cases of lobectomy. Over-

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holt⁷ combined resection with costoverision thoracoplasty in several cases, but later abandoned the procedure in favor of the method described in this paper.

It should be stated that delayed thoracoplasty following lobectomy probably results in collapse of only the apex of the over-distended lobe. This is due to the formation of postoperative pleural adhesions which limit the mobility of the remaining lung tissue.⁵ Delayed thoracoplasty, then, can only partially answer the problem of postresection over-distention.

The classical type of thoracoplasty is accompanied by the danger of a mobilized thoracic wall and paradoxical respiration. Many surgeons have avoided using the combined type of procedure; justly fearing the hazards of thoracoplasty involving more than three ribs. In his discussion of Conklin's paper, Dr. Richard H. Overholt first described a method of modified segmental *tailoring* thoracoplasty developed to eliminate this problem.

TECHNIC OF OPERATION

The operation is designed to accomplish partial or complete pleural space obliteration at the time of resection without undue mobilization of the thoracic cage. The technic of the procedure is comprised essentially of five steps (figs. 1, 2). The first step consists of transpleural, costochondral division of the ribs to be treated after completion of the resection and before the transcostal incision is closed. The ribs are divided with a scalpel at the costochondral junction. In all instances where this type of combined thoracoplasty and resection is anticipated, the original operative entry into the thorax is made by resection of an appropriate rib. The fourth or fifth rib is chosen in cases of lobectomy, and the sixth rib is removed in the instance of pneumonectomy. All ribs above this originally resected rib, with the exception of the first rib, are treated by the method of rib shortening to be described. Following the insertion of intercostal pleural space drainage tubes, the transcostal thoracotomy incision is closed in the customary manner. In the second step, the ribs to be treated are divided just lateral to the costal tubercle, and the periosteum is stripped away from the under surface of the first rib. This maneuver creates a hinged costal plate, which can be folded medially and downward. This allows accurate measurement of the posterior rib segments to be resected. The third step consists of the removal of appropriate posterior segments of the ribs after elevation of the periosteum in the usual fashion. In the fourth step, the shortened ribs are reflected downward and inward to approximate the remaining posterior rib ends. These shortened ribs are then securely lashed to the posterior rib stumps. It will be found that the shortened anterior ends tend to be displaced downward, so that the second rib comes to underlie the third posterior stump, the third will underlie the fourth posterior stump, and so on. The lower-most rib of this hinged costal plate will thus lie adjacent to the posterior end of the rib originally resected in the thoracotomy procedure. The rib edges are usually notched to allow firm approximation. Lashing is accomplished by the use of heavy black silk, inserted through drill holes in the rib ends. It should be noted that the region of this posterior fastening lies under the

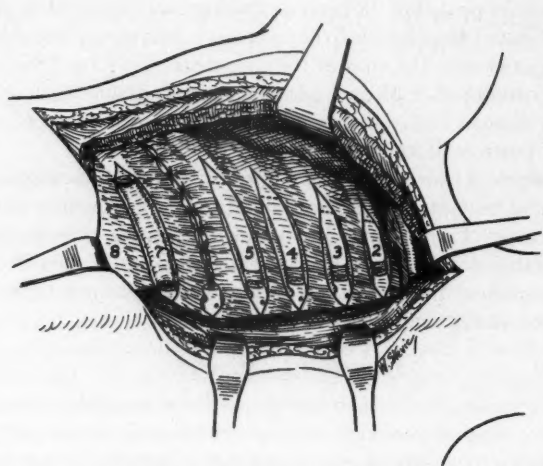


FIG. 1. Costochondral rib division has been accomplished and the posterolateral thoracotomy incision has been closed. The ribs have been divided posteriorly, and apicolysis has been done under the first rib. Part of the seventh rib has been excised (step no. 5). Segments of ribs to be removed are indicated.

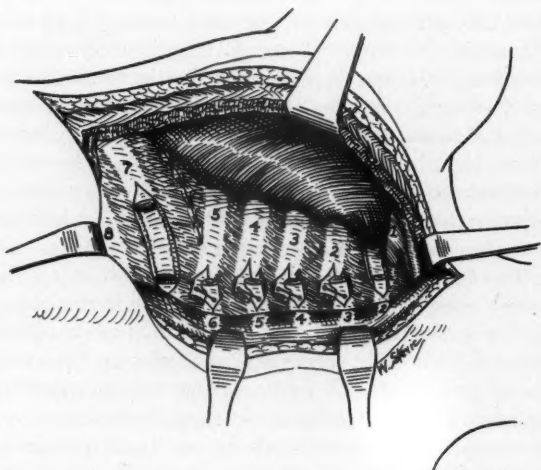


FIG. 2. The appearance of the completed modified thoracoplasty is shown. The shortened ribs have been notched and drilled, approximated in cross-stick fashion, and securely lashed together with heavy silk. Reduction of pleural space volume is evident. Thoracic wall stability has been restored.



FIG. 3a



FIG. 3b

FIG. 3a. A 24 year old white woman with unexpandable pneumothorax on the left of four years duration. Because of advanced lung destruction prior to the institution of pneumothorax, plus the presence of bronchiectasis, decortication or thoracoplasty alone was contraindicated.

FIG. 3b. Left pneumonectomy combined with thoracoplasty was done. The late postoperative roentgenogram shows the rather unusual roentgenologic appearance of this type thoracoplasty in cases where pneumonectomy has been done. Mediastinal displacement and scoliosis are minimal. Function of the remaining lung is good.

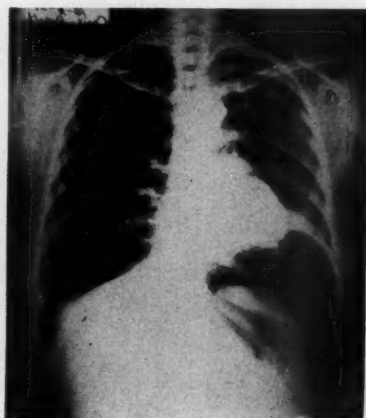


FIG. 4a

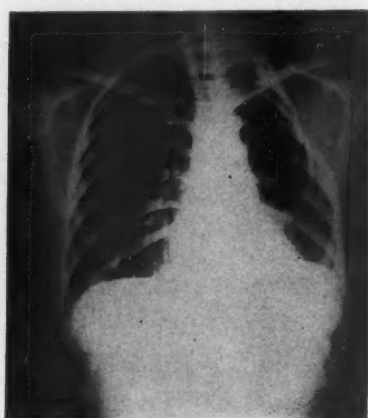


FIG. 4b

FIG. 4a. The case of a 32 year old white woman whose clinical course suggested that the cavity in the left upper lobe was a *tension* type cavity. This was confirmed by bronchography and bronchoscopy.

FIG. 4b. The late postoperative roentgenogram following left upper lobectomy and concomitant thoracoplasty, shows the end result and illustrates the characteristic appearance of this thoracoplasty when used with lobectomy. The reduction of the size of the remaining pleural space has been adequate.



FIG. 5a



FIG. 5b

FIG. 5a. A case of *destroyed lung* with extensive cavitation and a mixed infection empyema with bronchopleural fistula on the left side in a 45 year old white man. The contralateral disease on the right was considered reasonably stable.

FIG. 5b. This patient was treated by left pleuro-pneumonectomy combined with a 7-rib thoracoplasty. The late postoperative result is shown. Sputum has converted and recovery was uncomplicated. Pneumoperitoneum treatment is still being continued and is present in both pictures.

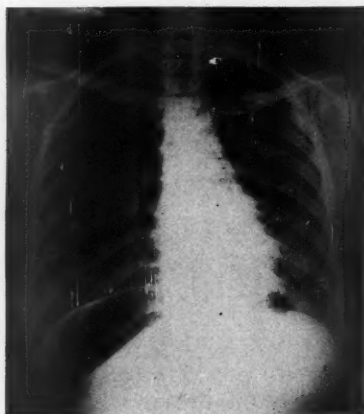


FIG. 6a



FIG. 6b

FIG. 6a. A colored woman, age 37, with a large tension-type cavity in the posterior segment of the left upper lobe, confirmed by bronchography. The lower lobe shadows on the left are residuals of radiopaque iodized oil.

FIG. 6b. A left upper lobectomy and tailoring thoracoplasty was done by the method outlined. The late postoperative roentgenogram shows the reduced left thoracic cage volume, and illustrates the absence of appreciable shift, deformity, or over-distention.

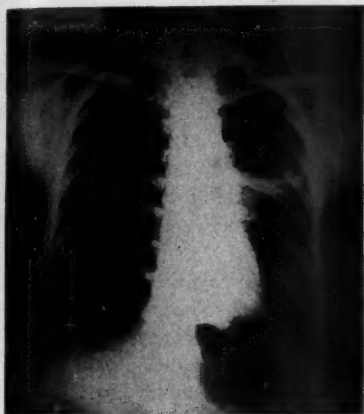


FIG. 7a



FIG. 7b

FIG. 7a. A 35 year old white woman with a giant left upper lobe cavity, and a second cavity in the superior segment of the left lower lobe. Pneumoperitoneum is present.

FIG. 7b. Left pleuro-pneumonectomy and combined thoracoplasty were done. The late postoperative roentgenogram is shown with continued pneumoperitoneum for further therapy. This patient later reopened a previously healed right apical cavity, and is still under treatment.



FIG. 8a

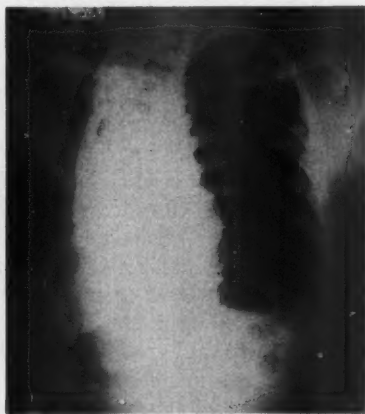


FIG. 8b

FIG. 8a. Pneumonectomy was advised in this 26 year old colored man for a severely involved right lung with multiple excavations and partial atelectasis following a tuberculous pneumonia. Following nine months of treatment with antibiotics and rest plus pneumoperitoneum, a right pneumonectomy and 7-rib tailoring thoracoplasty were done.

FIG. 8b. The final result shows the presence of slight mediastinal deviation, but no more extensive than in the preoperative roentgenogram. Sputum has converted and residual lung function is unimpaired.

sacrospinalis muscle mass, which tends to adequately cover the rib ends. The fifth step is desirable in most cases of pneumonectomy. This consists of the removal of an additional posterior segment of the seventh rib in the usual fashion. This maneuver prevents formation of a ledge and the uncomfortable impingement of the scapula upon the remaining lower ribs. The entire above procedure adds less than 30 minutes to the operative time.

It must be emphasized that the combined operation should by *no* means be used routinely in all cases of resection. It should be used *only* when the condition of the patient during surgery warrants the added procedure. This combined operation obviates many of the objections to the usual classical thoracoplasty combined with resection. The integrity of the thoracic cage is immediately re-established by the process of reuniting the shortened ribs. In general, the postoperative course in the combined procedure has been excellent, and in most respects does not differ greatly from the course of the usual postoperative resection. We routinely employ underwater or 10 cm. suction drainage even in pneumonectomy cases. This promotes prompt obliteration of the dead space without undue mediastinal displacement.

One remarkable feature of this type procedure is the amazingly small resultant deformity evidenced by the patients so treated. The typical unilateral chest deformity is greatly minimized. Alterations of the shoulder level are minimal and postoperative scoliosis has been practically negligible. It is our belief that avoidance of scoliosis is very important, since it may contribute to a late contralateral over-distention. In all of our pneumonectomy cases, phrenic nerve interruption was done at the time of resection. There may be technical objections to this by some surgeons. It is our opinion, however, that the space obliteration accomplished by the operative procedure tends to splint the paralyzed diaphragm, and thus prevents the sequelae resulting from elevation of the diaphragm to unduly high levels. Phrenic nerve interruption may be postponed and secondarily done by the cervical operative approach at a later date, if it is desired.

In our series of 18 cases treated in this fashion, we have had one postoperative death occurring approximately three hours after pneumonectomy combined with thoracoplasty. This was due to right heart failure and acute pulmonary edema, probably related to excessive parenteral fluids given during and immediately after the operative procedure. Other than the one immediate postoperative death, we have had only one complication. This consisted of a bronchopleural fistula manifested on the tenth postoperative day. The fistula was accompanied by an empyema, which necessitated an eventual modified Schede thoracoplasty. This patient was later admitted to another institution where a pneumonectomy was done that resulted in the patient's death shortly after operation. This death occurred approximately six months following the original procedure. The results in 6 patients are illustrated in figures 3 to 8.

SUMMARY

Over-distended lung tissue following resectional surgery frequently leads to reduced pulmonary function and in some instances to late pulmonary or cardiovascular strain.

Over-distention is particularly undesirable in cases of tuberculosis, where latent foci may be activated following any type of resection.

Obliteration of the dead space following pulmonary resection, therefore, is often of paramount importance in the treatment of bronchopulmonary disorders by resection.

The advantages of combined resection and thoracoplasty from the economic and patient cooperation standpoint are self-evident. Following partial resection the formation of pleural adhesions tends to defeat, in part, the purpose of later thoracoplasty in preventing over-distention and postoperative emphysema.

The author presents a method of multiple segmental thoracoplasty originally devised by Dr. Richard Overholt, in which partial or complete pleural space obliteration can be safely accomplished at the time of resection.

The method outlined re-establishes the integrity of the thoracic cage, thereby effectively preventing paradoxical chest wall movement, and eliminating many surgical objections to the classical, multiple rib thoracoplasty.

A series of cases demonstrating the use of this combined procedure is presented by illustrations.

The combined operative procedure has been well tolerated in almost every instance. In the series of 18 cases, there has been one immediate postoperative death and one complication due to bronchopleural fistula and empyema.

DISCUSSION BY DR. DONALD S. PAULSON, DALLAS, TEXAS

Dr. Stone has discussed a very important phase of the surgical treatment of pulmonary tuberculosis. The method used by Dr. Stone is one of many procedures which may be utilized to prevent over-distension of the remaining lung tissue after pulmonary resection. There can be little question about the desirability of combining the resection and thoracoplasty in one procedure, where indicated. It must be admitted, however, that the morbidity of the combined procedure is increased and that the postoperative care becomes more complicated, particularly in reference to the prevention of atelectasis. This is due to the interruption of multiple thoracic rib segments producing increased pain and interference with the patient's ability to cough effectively. For the same reason respiratory function is compromised both in the early and late postoperative periods. Gaensler and Streider have shown that, following pneumonectomy, the use of oil, plastic sponge or air under slightly positive pressure obviated entirely over-distension of the remaining lung. Such prostheses, of course, were introduced in the presence of intact thoracic rib segments and did not reduce ventilatory function. Thoracoplasty, on the other hand, did cause a definite loss in ventilatory function. It is also known that extrapleural or extrafascial plombage effects pulmonary function to a far less degree than thoracoplasty. In other words, it is desirable to preserve the integrity of the thoracic rib segments from a standpoint of respiratory function. It is probably true that, when more than three or four rib segments are interrupted, a significant reduction in ventilatory function occurs. For this reason, one should be conservative in the application of combined resection and thoracoplasty and utilize it only when clearly indicated on the basis of the individual problem of tuberculosis. For

instance, it would not be applicable to a shrunken lobe where over-distention has already occurred, nor should it be used with segmental resection.

By the same reasoning, phrenic nerve crush or interruption following either pneumonectomy or lobectomy reduces lung function and in my opinion should be avoided. Whether lung tissue remains on the same side or not, a paralyzed or paradoxical diaphragm reduces ventilatory function.

It would be interesting to know how much the method described by Dr. Stone effects ventilatory function by actual measurement.

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THE THORACOABDOMINAL APPROACH TO THE UPPER ABDOMEN

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A change in the concept of upper abdominal surgical exposure has been stimulated in recent years by a number of factors. The exposure limited by the costal margin, the inaccessibility of upper abdominal lesions close to the dome of the diaphragm, the inaccessibility of lesions deep in the upper abdomen, the size of the liver, and lesions which require for their surgical repair by both abdominal and thoracic exposure, are the most important factors producing variations in surgical procedures.

Attempts by surgeons to broaden exposure for upper abdominal lesions by crossing the costal arch were reported in the literature as early as 1896. The historic aspects of the development of the thoracoabdominal approach have been excellently covered in recent articles by Carter, Phemister, and Pack and McNeer. Since 1946 the literature has been replete with articles advocating a thoracoabdominal approach for a number of upper abdominal and thoracic conditions.

Exposure by thoracoabdominal incision may be accomplished in a number of ways. One may extend the abdominal incision across the costal margin to or into the pleural space. One may make a primary thoracic incision and enter the abdomen either by dividing the costal margin or by entering directly through the diaphragm. Another method is the use of two separate incisions, one thoracic and one abdominal.

Incisions may be made in either the right or left abdomen or thorax, the final decision depending upon the surgical problem. On the right side, thoracoabdominal exposure has been used for a number of procedures, principal of which are the portacaval shunt, repair of injuries to the common bile duct, cholecystectomy and choledochostomy, midthoracic esophageal carcinoma, adrenal tumors, and thoracolumbar sympathectomy.

The greater number of lesions are approached by thoracoabdominal exposure from the left side. Some of these procedures are as follows: high and low esophageal carcinoma, esophagogastric carcinoma, total gastrectomy for fundal carcinoma or other fundal lesions, diffuse polyposis of the stomach, splenectomy, splenorenal shunt, achalasia and other benign esophageal lesions, adrenal tumors, diaphragmatic hernias, thoracolumbar sympathectomy, and vagotomy.

It should be apparent, and we should like to emphasize, that thoracoabdominal exposure is not *always* the method of choice in the above procedures. When

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exposure is inadequate with standard incisions, either because of the patient's anatomical or nutritional makeup or the presence of complicating factors necessitating greater exposure, the extension into the thorax or abdomen can be extremely helpful. However, when the lesion can be easily and adequately handled through a much smaller incision and more limited exposure, the exten-

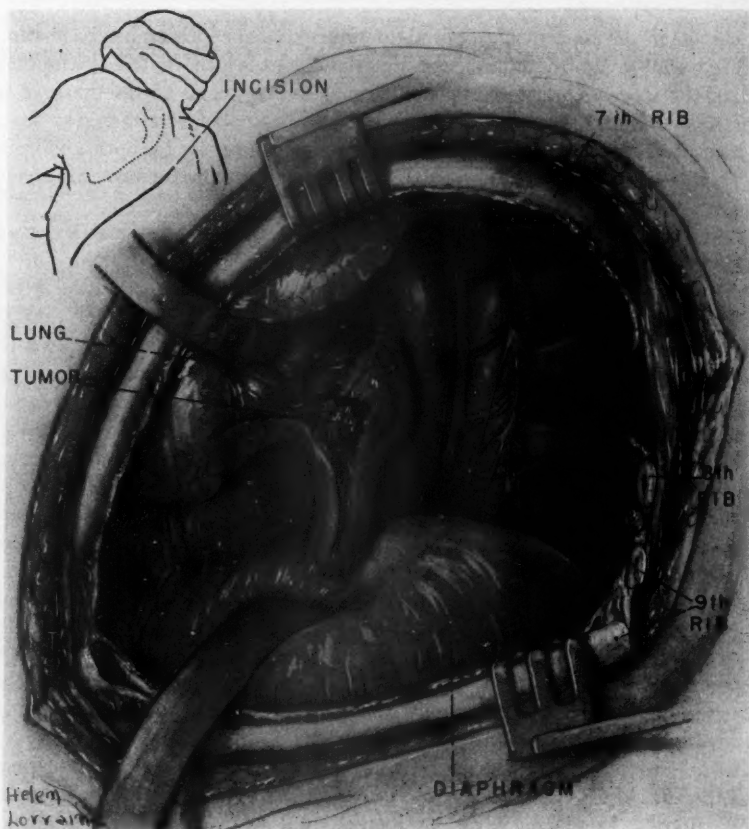


FIG. 1

FIGS. 1 and 2. Exposure in transthoracic transdiaphragmatic approach for lesions requiring esophagogastrrectomy is shown. Division of the diaphragm from the esophageal hiatus outward gives good exposure of the upper abdomen. Division of the ninth rib, as shown, is usually not necessary. Note division of intercostal muscle above eighth rib.

sion of any incision which prolongs the operative time and increases the possibility of surgical shock and postoperative morbidity is fundamentally condemned (figs. 1 & 2).

For malignant lesions in the lower one-third of the esophagus, where anastomosis can be accomplished below the aortic arch, and for esophagogastric

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carcinoma, exposure is best accomplished through a thoracoabdominal incision. The patient is placed in the lateral position, left side uppermost. With this position the heart is displaced anteriorly and to the right. The incision follows the left eighth or ninth rib from near its angle to the costochondral junction. A long segment of rib is removed subperiosteally and an incision is made into the

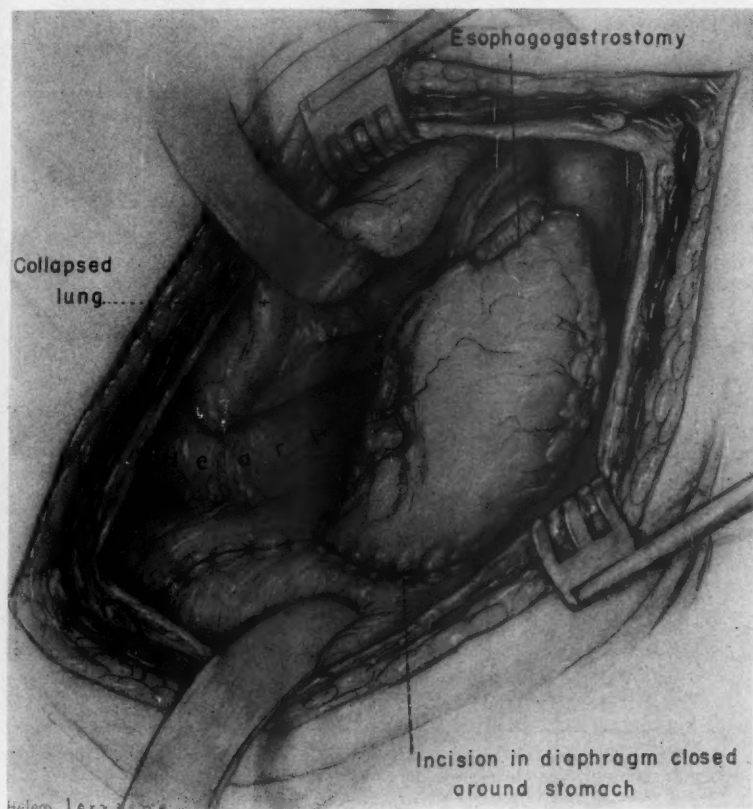


FIG. 2

pleural space through the periosteal bed. The intercostal muscles should be divided well back toward the rib articulation on the upper surface of the resected rib. If it is found that more room is needed, the ribs above and below may be divided, or the chondral arch may be divided, and the incision extended into the abdomen.

In the case of a suspected nonresectable esophagogastric lesion, with a large portion of the stomach involved, it is wise to enter the abdominal cavity first. A nonresectable lesion can usually be recognized by this method, obviating the

necessity for entering the thorax (fig. 3). If a resectable lesion is found, the costal margin is divided and the chest opened as described above. In the routine case, where the thorax is entered first, and resectability is established after mobilizing the esophageal lesion, the abdomen is entered through the diaphragm.

Total gastrectomy for gastric lesions without involvement of the esophagus has been done through a thoracic approach and has been advocated by many (fig. 4). Our own experience has been with the abdominal approach, converting the vertical left midrectus incision into a hockey stick incision by crossing the

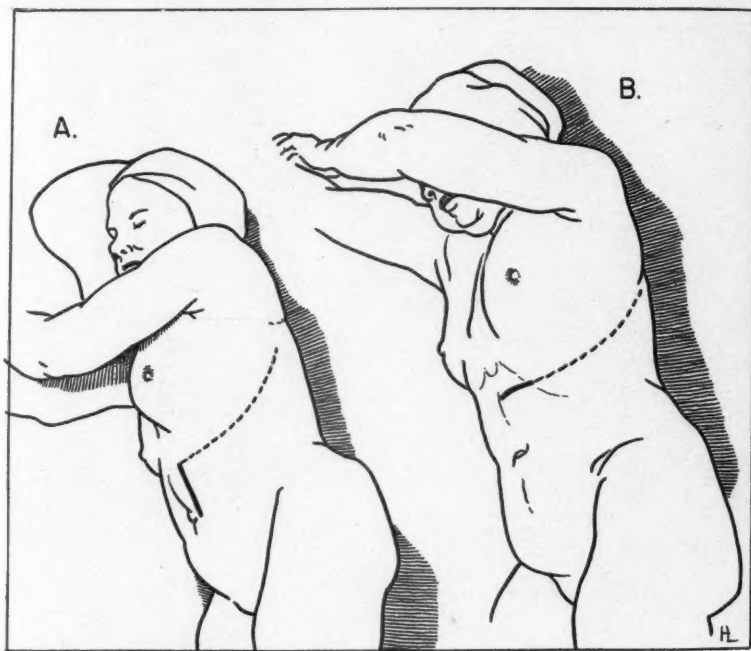


FIG. 3. Simple exploratory abdominal incisions to establish operability in suspected nonresectable esophagogastric carcinoma as shown may be extended into thorax along eighth rib if resectability is established.

chondral arch and entering the sixth interspace, or lower if an enlarged heart is felt or known to be present. The pleural space is entered or not as the situation demands. The added exposure gained by simply dividing the chondral arch will, in many cases, be sufficient. If, however, additional exposure is needed, the sixth interspace is entered and the diaphragm divided. Since the esophagus is not involved and the total length of the esophagus is available for anastomosis, the decubitus position does not cause trouble by an overhanging heart because the anastomosis is usually done below the diaphragmatic level. One can obtain a much better appraisal of metastatic spread in the case of malignant gastric lesions with the abdominal approach. In our experience mobilization of the

omentum and the nodebearing areas around the duodenum are much more easily accomplished by this method.

For the very large spleen, and for the procedure of splenorenal shunt for portal hypertension, we have used the following procedure to great advantage (fig. 5).

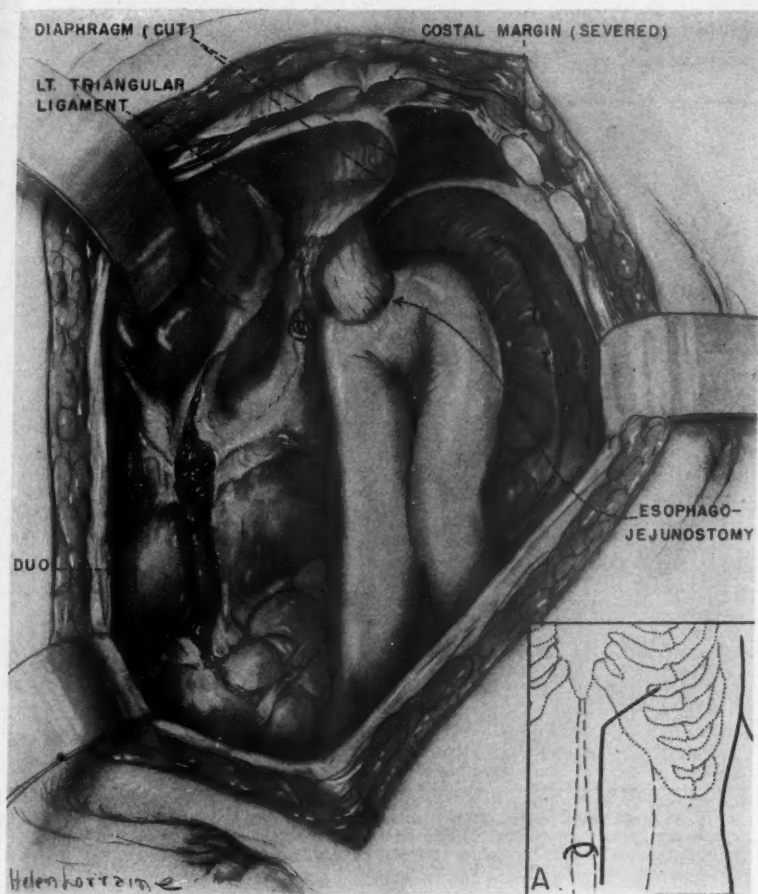


FIG. 4. Exposure is obtained by crossing the costal arch for lesions requiring total gastrectomy. The pleural cavity has been deliberately entered here, but this is not always necessary. Note that in most lesions requiring total gastrectomy the esophagojejunostomy is done below the diaphragmatic level. A much better dissection and appraisal of the situation in malignant lesions of the stomach can be obtained through the abdominal approach.

The patient is placed in the right lateral position, left side up. Incision is made over the left ninth rib and directed toward the umbilicus, across the left anterior abdominal wall extending almost to the umbilicus. The ninth rib is removed subperiosteally near the angle. The thorax is entered first. The abdomen is then

entered and the costal margin is divided. The diaphragmatic incision is made just lateral to the transverse ligament of the diaphragm. Use of this incision insures excellent exposure to all surfaces of the spleen and the splenic pedicle. Exposure is excellent for ligating the branches of the splenic vein close to the hilus, which is necessary to obtain sufficient length of the splenic vein for proper accomplishment of a splenorenal anastomosis. The renal and suprarenal areas are easily accessible.

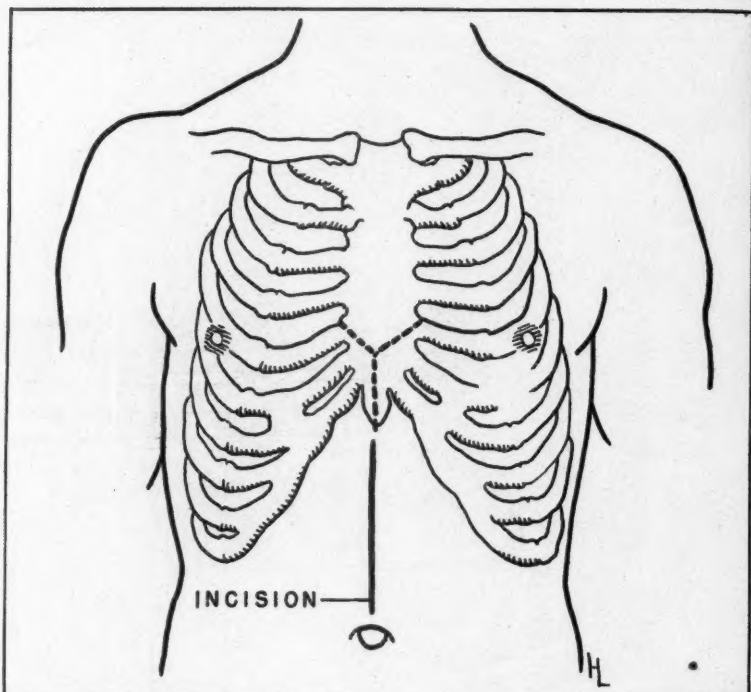


FIG. 5. As an alternative to figure 4 in total gastrectomy the xyphoid and sternal splitting maneuver, after the manner of Wangenstein, will give the necessary added exposure. The added time and morbidity make this less desirable.

A similar incision is used for the portacaval shunt procedure which we now prefer to the splenorenal shunt for most cases of portal hypertension (fig. 6). On the right side the diaphragmatic incision should be extended down past the transverse ligament in order to allow enough room for displacement of the liver into the right chest. The liver can be held out of the way nicely with Deaver retractors covered with stockinet. Excellent exposure of the vena cava, the hilus of the liver, the head of the pancreas, the kidney, and adrenal is obtained. Resection of a large renal tumor adherent to the vena cava could be very well done through this exposure. The actual portacaval shunt is rather simple when using

this approach. The main difficulty is the venous vascularity present in portal hypertension which requires tedious work and time to dissect through to the vena cava.

Recently right-sided thoracoabdominal incision has been advocated for more adequate exposure of the hepatic hilus in reconstructive surgery of the common duct. We have never used this incision for such reconstructive surgery, but are well aware of its advantages should the need ever arise.

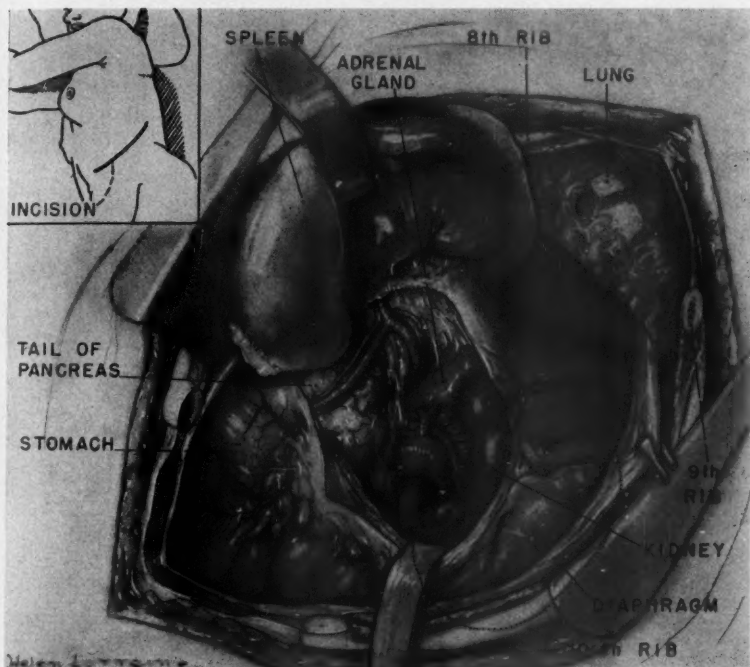


FIG. 6. Wide exposure is obtained by using the incision described. The incision follows the left ninth rib and extends across the abdomen almost to the umbilicus. A huge spleen can be removed easily with such exposure. Accessibility to splenic and renal vessels, suprarenal gland, kidney and tail of pancreas is indicated.

Excision of esophageal malignancies which require esophageal anastomoses above the arch of the aorta, have presented difficult surgical problems. Such lesions include probably all of those above the lower one-third of the esophagus. Realization of the accessibility of the esophagus in the right chest resulted in the use of the right chest attack by Macmanus in 1948 in solving this problem.

In the past year we have been using the two-incision approach (fig. 7). A routine left midrectus incision is made extending from the xiphosternal angle to below the umbilicus. Through this abdominal incision the stomach is completely mobilized from the origin of the right gastric and right gastroepiploic arteries to

the esophageal hiatus. The esophagus is then entirely freed from attachments at the esophageal hiatus as far as is possible. This is facilitated by division of both vagus nerves. The abdominal incision is then closed. The patient is turned on the left side and redraped. The thorax is opened at the level desired through a posterolateral incision, mobilizing the scapula if necessary. If the lesion is now

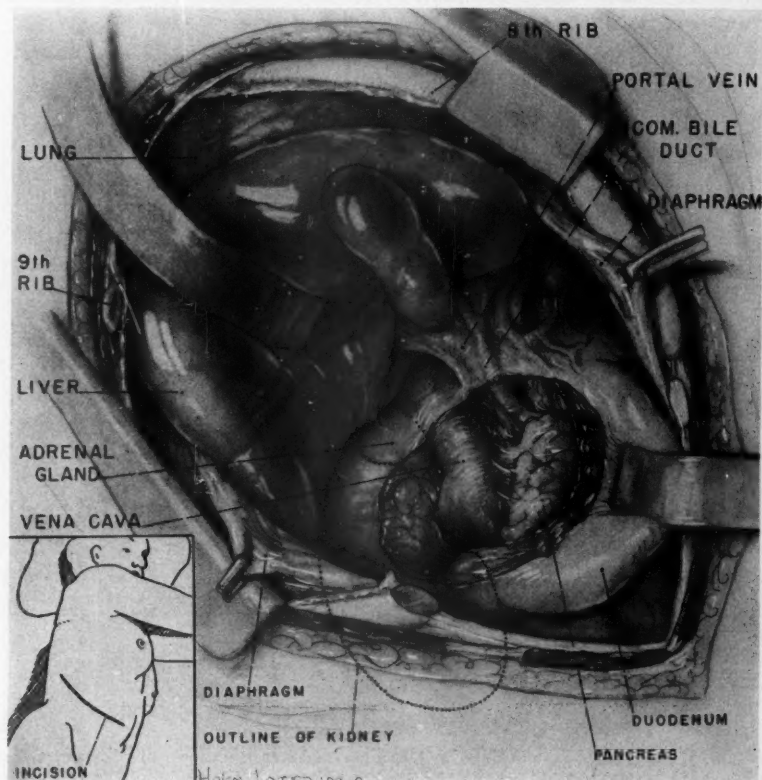


FIG. 7. The incision is similar to figure 6 on the right side. With the right lobe of the liver displaced into the right thorax, excellent exposure of the porta hepaticus, the vena cava, the structures in the gastrohepatic ligament, as well as the right suprarenal gland, is obtained.

found to be inoperable, no harm has been done, only the time wasted necessary to mobilize the stomach. If the lesion is resectable, the esophagus is freed entirely up to the desired point of anastomosis. The stomach is brought up beneath the vena cava (figs. 8 & 9). We have found no great difficulty in using this incision. The patient certainly has a much smoother postoperative convalescence with a much more stable chest wall.

Esophageal and other types of diaphragmatic hernias must be considered in this discussion, since the thoracoabdominal approach for their repair has been

advocated by certain authors. It is our own impression that diaphragmatic hiatus hernias or paraesophageal hernias are best repaired through a thoracic incision. Recently we attempted the use of the sternal and xiphoid splitting incision in the repair of a hiatus hernia; the incision recommended by Wangenstein

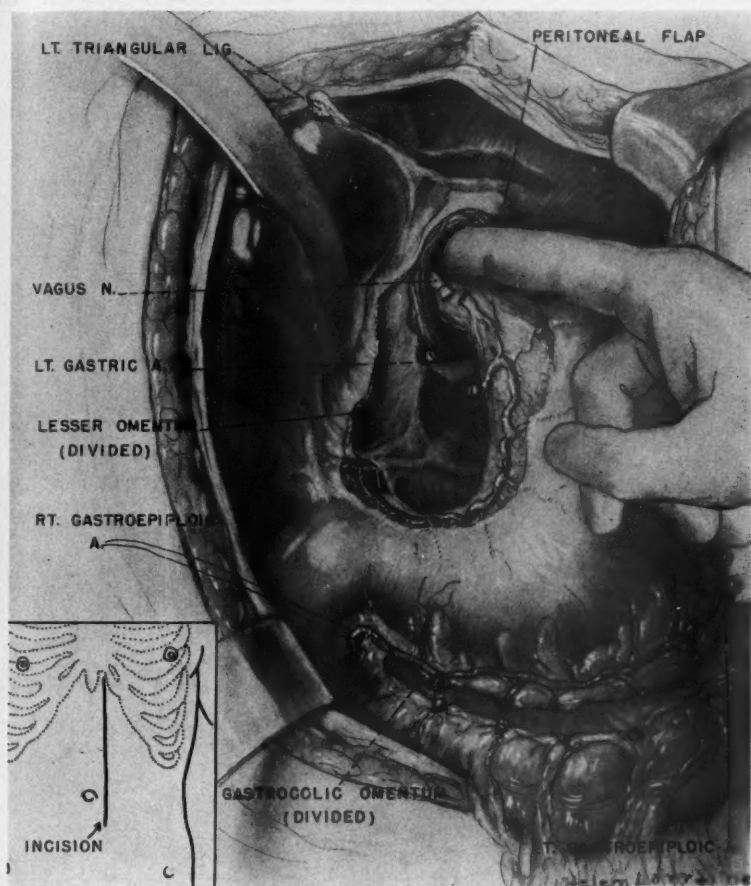


FIG. 8. Almost complete mobilization of the stomach preparatory to delivering that organ into the right thorax is shown. The right gastroepiploic artery may be sacrificed to add greater length when cervical anastomosis is contemplated. Even with this wide mobilization the stomach remains quite viable if, on the thoracic stage, the lesion proves to be nonresectable. High blunt finger dissection around the esophageal hiatus is necessary.

or many upper abdominal lesions, including the hiatus hernia (fig. 10). Exposure in our case was adequate, but the postoperative discomfort experienced by the patient, and the much greater ease by which exposure could have been obtained through thoracic approach, caused us to abandon this type of incision.

We have had no direct experience with transthoracic transdiaphragmatic

resection of adrenal tumors. However, the accessibility of the adrenal gland through this approach has been apparent since we first started the use of the transthoracic approach for thoracolumbar sympathectomy in 1946. Indeed, the last 10 such procedures have included the deliberate resection of one adrenal gland. With the work of Wolfreth, Zintel and others in mind, we believed that,

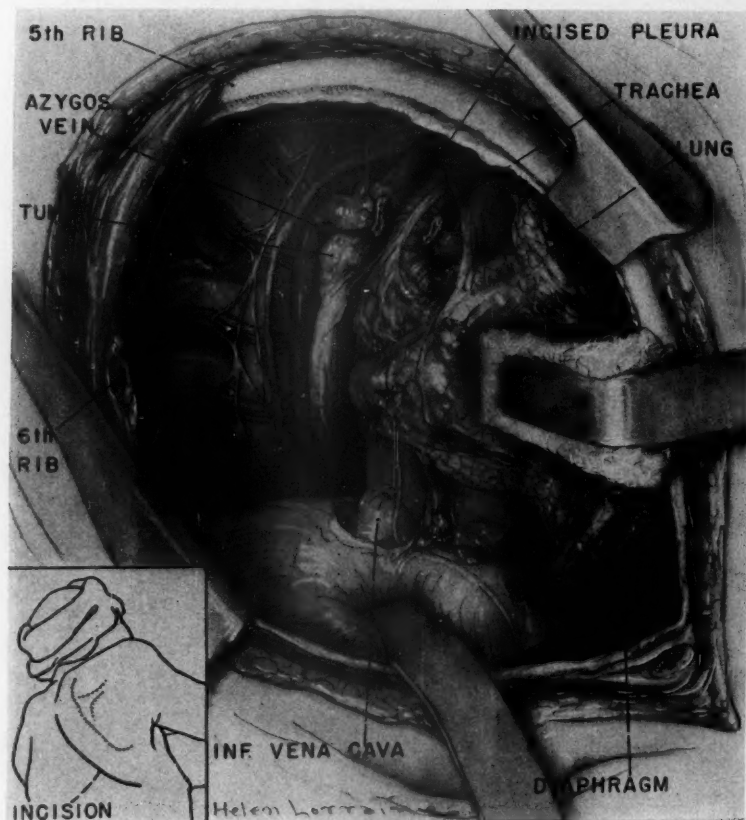


FIG. 9. Accessibility of esophagus in the right chest is shown. The azygos vein is the only structure crossing the esophagus here. The level of the thoracic incision depends on the height of the lesion. Ordinarily resection of the sixth rib with partial mobilization of the scapula affords adequate exposure.

in those patients who did not respond well to sympathectomy, subtotal bilateral adrenalectomy, if indicated at a later date, would be a much simpler procedure.

Benign stricture of the lower esophagus has been treated in many ways. Dilatation has proved so effective in our experience that we have had no use for the surgical approach to this lesion. Thoracoabdominal incision has been used by others for the simple Heineke procedure. More recently proximal esophagogas-

trectomy has been advocated by Wangenstein and others for achalasia. The thoracoabdominal approach is the approach of choice for such a procedure.

Certain factors limit the use of thoracoabdominal incision. The most important is the lack of a competent anesthetist. All patients, in whom there is the possibility of thoracic incision and invasion of the pleural space, should have some

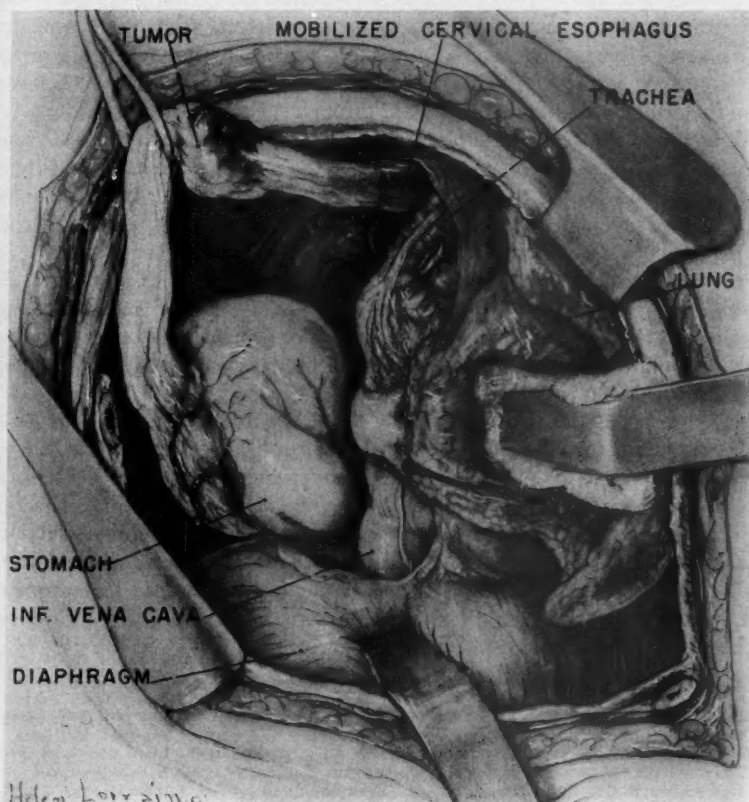


FIG. 10. Drawing shows complete mobilization of the esophagus in the right chest with the stomach partially drawn up behind the inferior vena cava. Angulation of the stomach through the esophageal hiatus has not been a factor in our cases. The ease of anastomosis in the left thorax is apparent.

type of closed intratracheal anesthesia with an anesthetist skilled in thoracic surgical anesthesia at the helm. The second limiting factor is the lack of indication for thoracic or abdominal extension of the incision. Another limiting factor is the obviously increased possibility of morbidity caused by the greater incision length and the entrance into two serous cavities, as well as the added length of time necessary to repair the thoracoabdominal incision. However, the operating time saved by adequate thoracoabdominal incision, the lack of heavy retraction

and consequent reduction of traumatic shock, and the absence of hidden blood loss, compensate for the above in properly selected cases.

Repair of thoracoabdominal incisions requires little comment. Repairs should be made in layers. The costal margins will approximate themselves if the diaphragmatic, thoracic and abdominal wounds are closed properly, and no costal suture is needed. The diaphragm should be repaired with interrupted nonabsorbable sutures and care should be taken to repair all defects around the esophageal hiatus, should this be divided. Early in our experience with esophageal resection and esophagogastrostomy, we had 2 cases with incarceration of the transverse colon following herniation of that organ through such a defect.

We have been in the habit of placing a posterior drain through the ninth intercostal space in the posterior axillary line when the pleural space has been entered. This drain is connected to a controlled suction apparatus, or merely clamped and aspirated periodically in the postoperative period. It is always wise to observe full expansion of the lung before the closure of the wound is begun.

Postoperative care, when the pleural space is entered, may be complicated only by the presence of fluid or air in the pleural space, atelectasis, and the management of the thoracic drain. If esophagogastric or jejunal anastomosis has been made, complications from this region should be recognized early and managed as indicated.

Our experience with summary of the thoracoabdominal approach to lesions of the upper abdominal cavity has proved to our satisfaction the ease with which selected lesions can be handled surgically by using this type of incision. We should like to emphasize, however, that extension of the abdominal incision into the chest, or vice versa, carries with it some degree of increased morbidity, and that the incision should be used only when it is necessary. We should also like to emphasize that the thorax should never be invaded unless one has competent anesthetic help, and a staff trained in the observation of thoracic surgical cases in the postoperative period.

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THE USE OF A NEW LONG LASTING LOCAL ANESTHETIC SOLUTION FOR THE RELIEF OF PAIN AFTER THORACOPLASTY AND PULMONARY RESECTION

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The control of pain following thoracic surgery is a problem of some magnitude. It is imperative that the patient breathe deeply and cough frequently, to keep the lungs fully aerated and to keep the bronchial secretions, purulent material, and at times blood, from accumulating and causing atelectasis. If analgesics are withheld, or given only in small quantities, pain tends to prevent the patient from breathing deeply or coughing. Analgesics in a sufficient quantity to fully control the pain usually diminish the cough reflex and respiratory excursion, resulting in the same condition that occurs when analgesics are withheld; namely, atelectasis. Thus, a compromise is usually attempted, with the hope that sufficient analgesic can be given to control the pain, without depression of respiratory volume and coughing. This balance is difficult to achieve. In the surgical treatment of pulmonary tuberculosis the problem becomes even more important than in other thoracic surgery, as the danger of dissemination of the disease through retained sputum is always present.

The value of intercostal nerve block in relieving pain following thoracic surgery is common knowledge. However, with the usual local anesthetic (procaine), the duration of anesthesia is only a matter of a few hours, and the repeated injections necessary for prolonged anesthesia shortly become obnoxious to both the patient and the doctor. Recently a long lasting local anesthetic solution, Efo-caine*, has been introduced. The active ingredients of the solution are procaine (1 percent), procaine hydrochloride (0.25 percent), and butyl-p-aminobenzoate (5 percent). The solvent is a mixture of polyethylene glycol-300 and propylene glycol, with phenyl mercuric borate (1:25,000) added for a preservative. When the solution comes in contact with the tissue fluids the active ingredients, being only slightly soluble in water, are precipitated out to form a crystalline depot. The solvent is rapidly absorbed. The crystalline depot is slowly absorbed over a period of days, providing a local anesthetic action until it is completely absorbed. Any nerves bathed by the absorbing fluid are completely blocked. A histopathologic study made by Weinberg⁶ of various tissues injected with Efo-caine failed to reveal any evidence of permanent damage or storage of Efo-caine.

Several reports²⁻⁵ of the satisfactory performance of Efo-caine in the relief of postoperative pain following various surgical procedures prompted a trial of it at the Western North Carolina Sanatorium for the treatment of tuberculosis. It was decided to use it on all patients undergoing surgery, unless multiple procedures were anticipated. In patients with multiple operations Efo-caine was used

From the Western North Carolina Sanatorium for the Treatment of Tuberculosis, Black Mountain, N. C.

* Made by E. Fougera & Company.

in alternate cases for the first operation, and in the remainder for the second operation. In other patients, on whom a second operation became unexpectedly necessary, Efocaine was not used at the second operation. Thus, the patients served as controls for themselves, which is a particularly satisfactory method of control, in view of the variability of the pain threshold of different patients. Neither the patients nor the ward nurses knew which patients received Efocaine; the postoperative orders were precisely the same in either case.

As an objective method of evaluating the effect of Efocaine, the doses of morphine given on the day of operation and the first three postoperative days were tabulated. Also, skin anesthesia was tested by sensitivity to pin prick, but never until after the fifth day, so as not to possibly influence the patients' requirements for morphine. Subjectively, the patients' voluntary remarks concerning a comparison of the discomfort encountered during the various procedures were noted, and further, the patients were questioned on this point after complete recovery had occurred. The patients were never told that they had received anything at the time of operation to relieve pain.

METHOD OF USE

Efocaine injection at the time of operation is usually quite simple. The intercostal nerve runs in a shallow groove on the inferior margin of each rib. Thus, with the chest open, by palpating the pleural surface of the rib with one hand, and the inferior margin of the rib with the needle tip, the injected solution can be accurately placed. If a nerve is actually exposed during resection of the rib, then the nerve can be directly injected, but the injection can usually be made more satisfactorily prior to the rib resection. One cubic centimeter of Efocaine per nerve is sufficient with either method of injection. Usually, the nerve or nerves corresponding to the resected rib or ribs are injected, with the two adjacent nerves above and below. For relief of pain other than operative, percutaneous injection is used, with the usual technic of intercostal block¹ being followed, but 2 cubic centimeters of solution are used to insure adequate contact with the nerve. If the patient is not anesthetized, then procaine anesthesia should be first induced to prevent the sudden but short lasting stinging pain that occurs when Efocaine is injected into unanesthetized tissue.

RESULTS

In 9 patients only one procedure each was performed (4 pneumonectomies, 2 lobectomies, 2 thoracoplasties, 1 decortication). Efocaine was used in each patient. These cases are itemized in Table I. The average quantity of morphine required per day for each patient for the first four days was 18 mg. (1.8 doses of 10 mg. each). Skin anesthesia was obtained in each patient (figs. 1 and 2).

Seven patients had two or more operations each, for a total of 17 operations. Each patient had at least one operation with, and one without, the use of Efocaine. Table II summarizes the pertinent data for this group of patients. For the 5 patients who had Efocaine used either at the first operation or following a tailored thoracoplasty, the average daily requirement of morphine was 18 mg., precisely the same quantity as for the patients shown in Table I. Skin anesthesia

was satisfactory in each case (fig. 3). The use of Efocaine following a second or third stage thoracoplasty was unsuccessful, because the nerves corresponding to



FIG. 1



FIG. 2

FIG. 1. W. N. C. 266 Decortication for tuberculous empyema. Seventh rib resected, and fifth through ninth intercostal nerves injected with Efocaine. Scored area indicates zone of anesthesia existing on the eighth postoperative day; anesthesia persisted through the tenth postoperative day.

FIG. 2. W. N. C. 2764 Left upper lobectomy for atelectatic lobe. Fifth rib resected, and third through seventh intercostal nerves injected with Efocaine. Scored area indicates zone of anesthesia on the eleventh postoperative day; anesthesia lasted through the twentieth postoperative day.



FIG. 3



FIG. 4

FIG. 3. W. N. C. 427 First stage thoracoplasty, with removal of first, second, and third ribs, for unexpanded lung following pneumothorax (bilateral disease). First through the fifth intercostal nerves injected with Efocaine. Photograph taken on sixth postoperative day shows zone of anesthesia, which persisted through the twelfth postoperative day.

FIG. 4. W. N. C. 2838 Drainage of post-pneumonectomy empyema. Severe pain around drainage site completely relieved by Efocaine block of three adjacent nerves. Scored area indicates zone of anesthesia 72 hours after the block was initiated.

the previously resected ribs could not be accurately located to permit satisfactory injections. Although areas of skin anesthesia were obtained, they were incomplete, and did not cover all of the dermatome segments involved by the incision.

TABLE I

Case No.	Operation	Rib(s) Resected	Nerves Injected	Duration of Skin Anesthesia (days)	Morphine Requirement*				
					Postoperative days				Total
					1	2	3	4	
2838	Pneumonectomy	7th	5, 6, 7, 8, 9	16	1	2	1	2	6
223	Pneumonectomy	5th	3, 4, 5, 6, 7	14	2	2	3	1	8
285	Pneumonectomy	5th	3, 4, 5, 6, 7	12	1	3	3	3	10
2819	Pneumonectomy	6th	4, 5, 6, 7, 8	21	1	2	1	0	4
2764	Lobectomy	5th	3, 4, 5, 6, 7	20	2	3	2	3	10
511	Lobectomy	5th	3, 4, 5, 6, 7	22	1	3	3	1	8
2817	Thoracoplasty	1, 2, 3, 4	1, 2, 3, 4, 5, 6	14	1	1	2	1	5
974	Thoracoplasty	1, 2, 3	1, 2, 3, 4	21	1	2	3	0	6
266	Decortication	7th	5, 6, 7, 8, 9	10	1	4	2	1	8
Averages				15.6	1.2	2.5	2.2	1.3	7.2

* Tabulated as the number of 10 mg. doses required.

TABLE II

Case No.	Operation	Rib(s) Resected	Nerves Injected	Duration of Skin Anesthesia (days)	Morphine Requirement*				
					Postoperative days				Total
					1	2	3	4	
33	Pneumonectomy	6th	none	none	2	3	4	2	11
	Thoracoplasty	2, 3, 4, 5, 7	2, 3, 4, 5, 6, 7	14	1	3	2	2	8
492	Lobectomy	5th	none	none	2	6	5	5	18
	Thoracoplasty	1, 2, 3, 4	1, 2, 3, 4, 5	26	2	3	3	1	9
2190	Thoracoplasty	1, 2, 3	1, 2, 3, 4, 5	18	1	2	1	1	5
	Thoracoplasty	4, 5, 6, 7	none	none	2	3	3	4	12
427	Thoracoplasty	1, 2, 3	1, 2, 3, 4, 5	12	1	3	1	1	6
	Thoracoplasty	4, 5, 6	none	none	2	4	4	3	13
	Thoracoplasty	7th	6, 7, 8	15	2	6	5	5	18
2054	Thoracoplasty	1, 2, 3	none	none	2	4	4	4	14
	Thoracoplasty	4, 5, 6, 7	4, 5, 6, 7	16	2	6	5	3	16
2558	Thoracoplasty	1, 2, 3	none	none	2	2	2	3	9
	Thoracoplasty	4, 5, 6	4, 5, 6, 7	15	2	5	5	1	13
	Thoracoplasty (Ant)	1, 2	none	none	2	3	3	4	12
2739	Lobectomy	6th	4, 5, 6, 7, 8	11	1	2	3	3	9
	Thoracoplasty	3, 4, 5	none	none	2	6	5	5	18
	Thoracoplasty	1, 2	none	none	3	5	3	2	13

* Tabulated as the number of 10 mg. doses required.

The average daily requirement of morphine for the cases in this classification, in which the injections of Efocaine were unsatisfactory, was 39 mg., slightly over double the quantity used in the successfully treated cases. For the nine operations performed without the use of Efocaine the average daily requirement of morphine per patient was 33 mg., approximately the same as when Efocaine was used unsuccessfully.

The duration of skin anesthesia, as shown in Tables I and II, varied from 10 to 26 days, with an average of 15.8 days. This corresponds closely to the duration (14.2 days) of skin anesthesia Puderbach and Shaftel⁶ obtained with Efocaine intercostal block to relieve pain after upper abdominal surgery.

Subjectively, the patients with successful Efocaine blocks appeared to have a much easier postoperative course than the patients without the blocks. Those patients who had operations with and without Efocaine were very cognizant of the fact that one postoperative course was much easier than the other, but didn't know why. It was noted that with a successful block coughing was much more spontaneous and was deeper and more productive. Further, movement of the ipsilateral arm returned to normal within a day or so after operation, and post-thoracoplasty deformity was less.

Four patients received Efocaine intercostal nerve block for relief of nonoperative pain. Two of these patients had pain around the site of empyema drainage tubes, 1 had pain in the area of a regenerating rib following pneumonectomy, and the fourth patient had pain in the anterior stump of the seventh rib following a two stage, seven rib thoracoplasty. Injection of the three nearest intercostal nerves gave complete relief of the pain and produced skin anesthesia in each case (fig. 4).

CONCLUSIONS

Efocaine, a long lasting local anesthetic solution, has been used to provide prolonged intercostal nerve block following various surgical procedures employed in the treatment of pulmonary tuberculosis, and to relieve chest wall pain caused by various conditions secondary to operation. Successful blockage of the nerves affected resulted in approximately a 50 per cent decrease in the quantity of morphine required per patient. It was found to be difficult, if not impossible, to achieve a satisfactory block if the ribs corresponding to the affected nerves had been removed previously.

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TECHNICAL SAFEGUARDS IN PARTIAL GASTRIC RESECTION

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Partial gastric resection is the most effective treatment for peptic ulcer that cannot be controlled by medical therapy. With the removal of at least $\frac{2}{3}$ to $\frac{3}{4}$ of the stomach, the operation has proved to be pre-eminently successful. In 85 to 95 per cent of the cases late results have been good to excellent.^{7, 4, 15, 16} Sarah Jordan, Chairman of the Committee for the Study of Surgical Procedures in Peptic Ulcer, states that partial gastric resection fulfills all five criteria for the control of ulcer in 86 per cent of the patients. From an extensive survey over all parts of the United States⁹, she reports that 94 per cent of the patients were satisfied with the operation and that 95.6 per cent were free from ulcer symptoms. Some authorities claim even better results. Hinton⁸ reported excellent results in 90 per cent of the resected patients. Certainly, the results of vagotomy do not compare with those of adequate gastric resection. Interest in the sleeve type of resection of the stomach or the Schoemaker modification of the Billroth I procedure has recently been revived.¹⁹

Notwithstanding the very excellent reports, many physicians still believe that partial gastric resection is too formidable for routine use in the treatment of a benign disease. Because of the difficulty in restoring weight to the preoperative *milk and cream levels*, many gastro-enterologists oppose the operation. However, relief of the chemical distress and the prevention of future hazardous complications by surgical intervention outweighs this opposition. The only distressing element in the treatment of peptic ulcer by partial gastric resection is the occasional occurrence of the *dumping syndrome*.

Dumping, a symptom complex, characterized by postprandial distress and profuse perspiration, usually appears almost immediately after meals and is preceded by a feeling of faintness, nausea, and the urge to defecate. The distress is fleeting and the attacks are exaggerated by the ingestion of sweets. Although *dumping* is usually transitory and self-relieved after the first few months, in 5 to 10 per cent of the patients, it is a real and serious debilitating complication of partial gastric resection. Machella¹³ attributes this complication to sudden dilatation of the upper jejunum from rapid emptying of the stomach. Stimulation of secretions of the upper intestine by hypertonic solutions promotes the syndrome.

The conclusions in this paper are based upon an analysis of 51 consecutive gastric resections performed by the author in the last five years. Gastric resection is a relatively safe and reliable procedure for the treatment of peptic ulcer. In the series of 51 resections, one death occurred. Three hours postoperatively, this patient developed cyanosis with collapse and died suddenly, presumably from

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embolism or coronary disease. Autopsy was not permitted. Eleven or 22 per cent of the resections were performed for massive bleeding from ulcers. No deaths occurred in this group (Table I).

TABLE I
Partial gastric resections for benign ulcers

	No.	Per Cent
Total number of patients.....	51	
With actively bleeding ulcers.....	11	22
Mortality.....	1	2

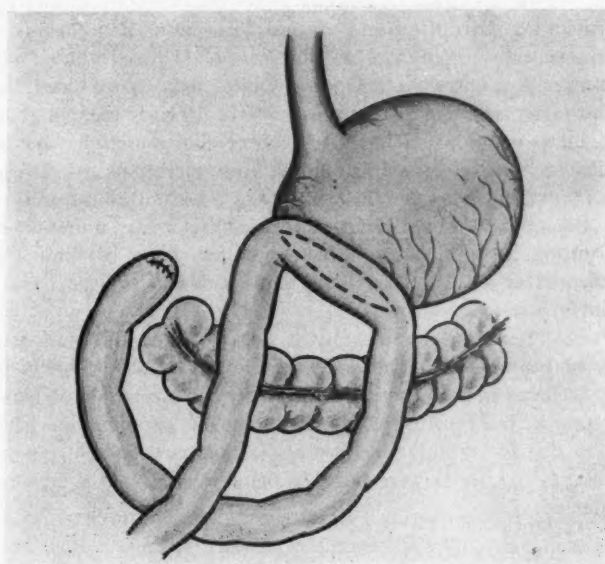


FIG. 1. Antecolic type of gastrojejunal anastomosis used by author. Note that the distal loop of jejunum is sutured to lesser curvature. Attempt is made to force the gastric contents to *spill over* into the jejunum and thus prevent or minimize the dumping syndrome.

COMPLICATIONS IN THE POSTOPERATIVE PERIOD

Most authors advocate the Polya type of retrocolic anastomosis, using a short loop of jejunum. To this, many add the Hofmeister modification.

Roscoe Graham,⁶ whose writings are responsible for the principal groundwork for present concepts of the physiologic approach to stomach surgery, has stressed, among many points, (1) adequate exposure through wide incisions, (2) careful hemostasis, (3) retroperitonization of the duodenal stump and (4) the importance of placing the *proximal* part of the stoma of the gastrojejunal anastomosis at a

level higher than the distal end of the stoma. In my experience, tendencies toward *dumping* have been minimized by the antecolic Moynihan procedure, with the distal end of the stoma at a higher level than the proximal, thus forcing stomach content to *spill over* into the distal jejunal loop (fig. 1). With this procedure, and by selecting the site for anastomosis at approximately 10 to 12 inches from the ligament of Treitz, none of a recent series of resections experienced any *dumping*. Other postoperative complications of partial gastric resection, regardless of the type of anastomosis, are essentially those of any major upper abdominal procedure, in addition to those unique to stomach surgery.^{11, 12, 13}

Among the common postoperative complications of upper abdominal surgery and its accompanying pain and limitation of respiration, pulmonic affections, such as atelectasis, pneumonia and thrombophlebitis and pulmonary embolus, are the chief sources for dread. Of perhaps lesser importance are the wound complications, including disruption and abscess formation. Pancreatitis, an occasional occurrence, may prove fatal. In the series of 51 cases studied, chest complications were almost entirely eliminated by intercostal nerve block, facilitating early ambulation by reducing the pain associated with early rising and permitting relatively painless coughing and raising of bronchial secretions that otherwise might predispose to atelectasis. Early ambulation in this series of cases implies that, *within the first 24 hours* usually the patient is permitted out of bed at least three times. Pneumonia did not occur and atelectasis was an unimportant factor. Wound disruption, a complication of lesser frequency, can be eliminated by the use of nonabsorbable sutures, using wide bites of fascia at least 1 cm. from the border of the incision.

A review of 393 resections reported by St. John¹⁸ demonstrates the multiplicity and variety of complications that may arise from gastric surgery. Of the 18 deaths that occurred in his series, 6, or 33 $\frac{1}{3}$ per cent were due to leakage from the stump, 4, or 22 per cent, were due to pulmonary complications and 3, or 17 per cent were due to thrombophlebitis and pulmonary emboli. Several of the patients in St. John's series were resected before the advent of antibiotics and early ambulation.

TECHNICAL HAZARD PECULIAR TO STOMACH SURGERY

The greatest hazard in the execution of gastric resection stems from the duodenal stump. One of the inherent difficulties of the operation, when closure of the stump must be made through the site of ulceration or stricture, is the hazard of insecure closure, enhanced by existing edema, fibrous scarring and fixation of the segment of bowel which is to be closed. Some authors have reported frank leakage of the duodenal stump in 3 per cent of their resections,^{1, 2, 10} a complication usually recorded as fatal.

The general principles of closure of the duodenal stump, advocated by Roscoe Graham, are still applicable. If mechanically feasible, a double running catgut suture closure with complete inversion of the serosa reinforced with a row of cotton sutures and final burying of the stump into the pancreas is ideal. However, if the duodenum is indurated and ulcerated it may be necessary to resort to a

simple purse string closure, in which case, reinforcements with interrupted Lembert sutures, bringing the anterior wall of the duodenum over the closed lumen is usually possible. At best, many times such closures prove to be insecure and, due to necrosis, leakage develops along the suture line. Introduction of a Penrose drain to the region of the duodenal stump is an excellent safeguard against soiling, resultant subphrenic abscess, and widespread peritonitis, should leakage occur (Table II).

A drain placed close to the duodenal stump forms a fistulous tract through which any leaking of duodenal content is shunted to the exterior. It serves as a safety valve, should leakage occur, and does not increase the incidence of rupture of the stump. Drainage of the duodenal stump was used in 17, or 33 per cent, of the 51 resections in this reported series. In 3, or 6 per cent, of the cases in which closure of the duodenal stump seemed insecure and drainage was instituted,

TABLE II
Partial gastric resections for benign ulcers

	No.	Per Cent
Total number of patients.....	51	
Duodenal stump drained.....	17	33
Fistulous drainage.....	3	6
Wound infection, minor.....	2	4
Subphrenic abscess.....	0	
Peritonitis.....	0	
Evisceration.....	0	
Thrombophlebitis.....	2	4
Delay in emptying of stomach.....	1	2

actual duodenal content was discharged externally, and in each instance, spontaneous healing, without residual disability, occurred within a period of two to six weeks. Drainage was instituted in 1 patient who was resected for bleeding ulcer. The drain was removed on the tenth postoperative day and a duodenal fistula developed on the twentieth postoperative day. There are recorded cases of rupture of the duodenal stump as long as six months following partial resection of the stomach.

Drainage of the duodenal stump is not a new idea. Billroth considered implantation of a tube into the duodenal stump in a deliberate attempt to form a duodenal fistula (quoted by Wolfier²⁰). Maingot¹⁴ suggested the use of a large catheter to aid in sealing perforations that are too large to close with suture. Priestly and Butler¹⁷ have recently advocated closing the duodenal stump around a catheter when suture of the duodenum might endanger vital adjacent organs, particularly the common duct. Those patients in whom secure closure of the stump cannot be effected, the use of a soft drain, extending to the region of the duodenal closure, serves as a safe and *controlled leak method* and eliminates the possibility of serious complications (fig. 2).

In contrast to the usual *lateral type* of duodenal fistula which is often fatal,¹

the *end type* is considered no serious threat to life. Brown et al² have demonstrated a 26 per cent mortality in *side fistula*, whereas, there was no mortality in their 15 patients with the *end type* of duodenal fistula.

In addition to the duodenal stump, a second potential site of leakage is produced by the gastrojejunal anastomosis. Although this complication does not appear in the recorded complications of larger series, obvious leakage and resultant subphrenic abscess following gastrojejunostomy has been observed in University Hospital patients. The use of an inner continuous layer of hemostatic

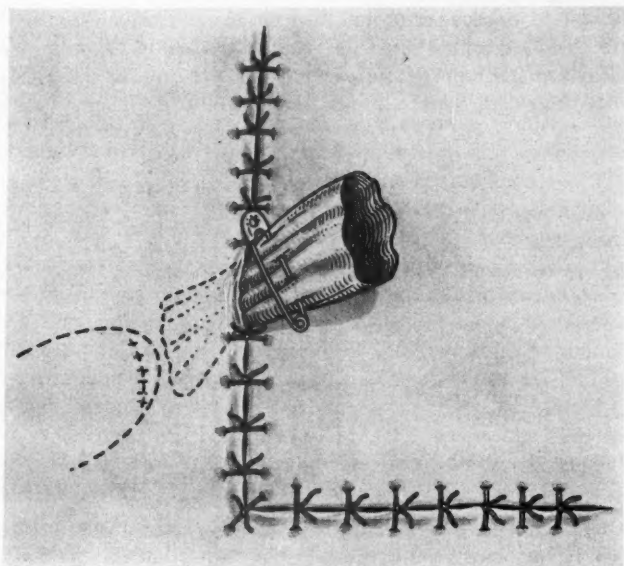


FIG. 2. Showing drain brought out through upper limb of wound. Drain is used only when the operator feels *insecure* about duodenal closure. Deep end of drain extends down to duodenal stump.

Also demonstrates the type of incision used in patients with narrow chest and high costal arches. Vertical limb extends from region of the umbilicus upwards in the linea alba to the xiphoid. Horizontal limb of the 'L' extends through the left rectus muscle.

catgut sutures and an outer interrupted layer of cotton sutures makes a safe and satisfactory type of gastrojejunal anastomosis. The use of rubber shod clamps prevents bleeding and aids in accurate suturing of stomach to bowel wall.

Uncontrolled bleeding at the anastomosis occasionally occurs and often requires re-exploration and resuturing within the first 12 hours. An excellent method to prevent postoperative bleeding from a gastrojejunal anastomosis, recorded by Fournier³ is the passing of sutures entirely through the bowel and stomach walls including areas on the mucosal side with no skipped areas on the serosal side. This theory is further substantiated in textbooks on histology which

demonstrates that the principal elastic and collagen fibers are in the submucosal layer of the stomach and jejunum. This is the layer in which the vessels are found. It therefore appears logical that any suture placed in the bowel should extend at least as deep as the submucosa or through the entire bowel wall to include the *tough layer*. This applies to any type of anastomosis of stomach to bowel, or bowel to bowel.

Unusual complications from technical errors in stomach surgery are injury to the middle colic or splenic artery. The close proximity of these vessels to the line of resection of the stomach demands meticulous care in freeing the lower end of the greater curvature, without injury to the vessels. Careful palpation and identification of the middle colic artery before the resection is begun will prevent accidents.

Included in this series of 51 cases is a patient who had a marked perisplenitis with fixation of the spleen. During gastrojejunal anastomosis the stump of the stomach which was quite short, was pulled down with such force that actual tearing of the splenic vessels occurred. Fortunately, the pedicle of the spleen could be grasped and bleeding controlled before exsanguination occurred. Splenectomy was done and the patient made an uneventful recovery. This experience indicates the advisability of testing the mobility of the spleen and freeing it of adhesions before starting the resection.

One complication in this series of cases, which has been discussed by Dr. Roscoe Graham,⁵ was nonfunction of the distal stoma. Re-exploration of a patient during my absence disclosed massive necrosis of the omentum. Although omental gangrene occurs infrequently following ligation of the blood supply along the greater curvature of the stomach it may account for difficulty in emptying of the stomach in the early postoperative phase. A delay in functioning of a properly constructed gastrojejunal anastomosis may occur. Dr. Graham has emphasized a *doing nothing* policy in such cases since nothing is to be gained by re-exploration. One patient, seen by me in consultation was sustained by feeding through a jejunostomy for 42 days before the stoma opened. In my experience delay in emptying of the stomach has never been followed by a *dumping syndrome*.

SUMMARY AND CONCLUSIONS

1. Partial gastric resection is the best operation in current use for the cure of peptic ulcer not controlled by medical therapy.
2. The mortality of partial gastric resection is being steadily reduced. Recent published series reveals an operative mortality of from 0 to 3 per cent.
3. The use of an antecolic gastrojejunal anastomosis with the distal jejunal loop placed high on the lesser curvature is advocated to prevent or to minimize the *dumping syndrome*.
4. A review of the various types of complications that may follow gastric resection is presented. An attempt is made to analyze the early types of complications.
5. Leakage of the duodenal stump is the greatest single cause of morbidity and mortality in resection of the stomach.

6. Drainage of the area around the duodenal stump by means of a Penrose drain is advised in some cases. It is re-emphasized that drainage of the region around the stump is the most effective way to deal with an insecure duodenal closure. A drain is used only when the surgeon believes that the closure of the duodenal stump has been unsatisfactory. A drain extending to the duodenal stump was used in $\frac{1}{3}$ of the 51 resections reported. Only 3 of the 17 patients who were drained developed a temporary duodenal fistula. All closed spontaneously without mortality or further complication.

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SURGICAL TREATMENT OF SURFACE LESIONS OF THE HEAD AND NECK

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Surface lesions of the head and neck, benign or malignant, occasionally are treated by almost every type of medical practitioner and by a great variety of methods. Unfortunately, the treatment of these lesions is also undertaken by many nonmedical cultists and healers, who seize the opportunity because of the widespread incidence of such lesions, their easy accessibility, and fairly good chance of cure, to employ their *macabre* unscientific methods. Newspapers, magazines and roadside billboards are replete with paid advertising for the removal of moles, hair, warts, and blemishes by electrolysis, salves, depilatories, and various other methods. What is to prevent these untrained persons from carelessly and inadequately treating a malignant melanoma or an epithelioma? Even recognized chemical laboratories advertise and distribute handy chemical kits for the indiscriminate treatment of every conceivable type of superficial lesion, with *complete satisfaction guaranteed*. This group of pathological lesions presents far too serious a problem in therapy to be handled by such haphazard methods. The cases of local recurrence, of advanced metastases, of tissue damage and other complications which follow inadequate primary treatment of such lesions call for more careful, scientific and exacting methods of treatment.

While several methods of treatment, when properly administered, may produce satisfactory results in superficial lesions about the head and neck, primary surgical removal with the scalpel can offer distinct over-all advantages, and has definite individual indications in certain situations which will be discussed.

Wide surgical excision should be the treatment of choice in surface lesions containing pigment. The fact that a pathological specimen for biopsy is made available in every instance is of inestimable value. Even long clinical experience cannot eliminate a certain percentage of error when used in lieu of the microscopic slide (fig. 1 (a)). When confronted with a deeply pigmented lesion on the surface of the skin, it may be difficult for one to differentiate, for example, between a blue nevus, a pigmented basal cell carcinoma, a malignant melanoma, a pyogenic granuloma, a seborrheic keratosis, a junctional nevus, or an epidermal cyst containing blood. Surgical excision and closure usually is possible in such instances and provides at once the pathological diagnosis, a complete removal, and a plan for follow-up care. While preliminary biopsy might prove radiotherapy to be applicable in the case of the pigmented basal cell carcinoma, it would be of no value in the other instances mentioned. Far too many pigmented lesions have been carelessly treated with the electric needle. We have seen cases of far advanced metastatic malignant melanoma where careful history revealed that a

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pigmented *mole* was destroyed by electrocoagulation or a similar device years previously without establishing a diagnosis. The careful systematized use of an electric needle can completely destroy such a lesion, by isolating it within a cylinder of skin and working toward the center, but the specimen is sacrificed without a diagnosis having been made (fig. 1 (b)). Excision and primary closure offers superior results cosmetically as well as safety and satisfactory healing. Furthermore, when the lesion is removed and the diagnosis is made, one is prepared to carry out any further indicated surgical procedure, such as a regional lymph node dissection in the case of a malignant melanoma. Moles about the head and neck should be removed if they are subjected to repeated trauma by shaving, combing, rubbing of clothing or by the pressure of spectacles. Change in size, color, vascularity, itching, ulceration, bleeding or inflammation are also indications for exci-



FIG. 1. (a) This blue-black lesion was widely excised with scalpel. Pathological diagnosis was benign nevus. (b) Non-pigmented lesion, clinically a *mole*, proved to be a solitary skin manifestation of leukemia.

sion of moles. All nonhairy, deeply pigmented lesions should be removed, even though they are not undergoing any changes or influences. Many moles are excised for cosmetic reasons alone.

Nonpigmented surface skin lesions may be treated by a variety of methods. In the case of a malignant skin lesion a reasonable choice usually exists between surgical excision and irradiation, depending primarily upon the location and extent of the growth. Irradiation may be preferred in malignant lesions of the eyelids, especially those involving the free edge of the lid, for example. An indication for surgical removal of such a lesion, however, would be the presence of an associated ectropion which could be corrected simultaneously with the removal of the lesion and with skin grafting of the eyelid. Lesions fixed to or invading cartilage or bone are generally more reliably treated by surgical excision, although by special adaptations of technic radiotherapists accomplish good results with such lesions. Radiotherapy is also useful in the treatment of malignant lesions about the nose, and the ala nasi, nasolabial, and naso-orbital regions, but surgical removal and plastic repair may offer equally good results in these areas.

Benign surface lesions including cysts, fibromas, keloids, cutaneous horns and the like are commonly excised, and here the pathological diagnosis is a very important part of the procedure. Surface hemangiomas usually offer no difficulty in diagnosis and their treatment ranges from excision to the use of attenuated doses of irradiation.

Many of the keratoses can be controlled with the liberal daily use of non-medicated white vaseline. Should they persist after such a trial further treatment is indicated. When the dry scaly outer portion is bluntly removed down to skin level and no bleeding occurs, electrodesiccation of the base should be adequate. A bleeding base, however, with induration or thickening, may mean that malignant changes are present and wide surgical excision is advisable with pathological examination of the specimen. Many early epidermoid carcinomas are revealed in this manner. The patient is instructed concerning regular follow-up visits and self examination at home.

Excision of surface lesions with a scalpel is superior to that with the electric knife, even though a biopsy specimen is obtained in each instance. The average surgeon tends to excise more widely when using the scalpel while the cautery tends to give one a false sense of security. The cautery causes delayed healing and more prominent scarring. Prevention of bleeding by the use of the cautery is of no particular advantage to the experienced surgeon. The cautery also alters the pathological specimen so that adequacy of depth and margins cannot be accurately shown. Verification of such adequate margins is a great source of comfort to the patient as well as to the surgeon. Scalpel excision is kind to tissues, and permits prompt healing with a minimum of discomfort. Good cosmetic results, with linear scars, are usually possible when proper attention is paid to the flexion creases and lines of expression. Putting the patient through a series of grimaces and exaggerated expressions will quickly determine the proper direction, extent and pattern of the excision.

Wherever primary closure may not be possible, as on the surface of the nose, and in the nasolabial, naso-orbital, and canthus regions, the use of the free skin grafts provides excellent coverage. Such operations are feasible as office procedures or in the hospital on an out-patient basis. Full thickness skin grafts usually are more suitable about the face than split thickness grafts, because of their uniform thickness; their more natural color and texture; less wrinkling or contracture; their ability to resist sunlight and all extremes of weather; their pliability wherever motion is desired, as on the eyelids; their ability to withstand the pressure of spectacles; and their ease of procurement. Full thickness grafts are highly probable when certain few *niceties* of technic are observed. The graft is never grasped or pinched with an instrument. Traction sutures deliver it from its bed, and it is touched only with the suturing needle thereafter. The recipient bed is made completely hemostatic and a comfortable immobilizing stent dressing is used. The donor areas may be quite large, but wound separation or breakdown can be prevented by *layer* closure of the dermis using interrupted fine sutures and working progressively outward from the center axis until the skin margins are eventually brought together and ap-

proximated with interrupted fine silk sutures. Usually no undermining is necessary. Most of these grafting procedures are done under local anesthesia, a factor which is of considerable importance to patients in the older age bracket.

A careful technic of scalpel excision permits accurate and safe removal of lesions in some of the more *difficult* areas about the nose, canthal regions, and eyelids. By using the sharp knife and a fine suction apparatus, and by dissecting slowly and carefully, one can be certain of the adequacy of the excision. Clear vision and the ability to palpate and distinguish normal from abnormal tissues, plus the fact that the specimen is kept on traction at all times with a safe margin of normal fat or connective tissue surrounding and holding it together, enables one to dissect surface tumors out of the more difficult and less accessible regions about the face.



(a)



(b)

FIG. 2. (a) This basal cell carcinoma, involving both eyelids, inner canthus, and lacrimal apparatus, was excised with scalpel, and defect grafted. (b) Appearance one year later without recurrence, with preservation of sight, mobility of eyeball, and complete eyelid function.

Surface lesions of the inner canthus can safely be removed with preservation of the underlying lacrimal apparatus. When the tumor invades deeply and involves the lacrimal duct, as may be suggested preoperatively by obstruction and epiphora, the duct is necessarily sacrificed (fig. 2). When the nasolacrimal system is invaded by tumor its function is usually permanently lost no matter what treatment is employed. Stenosis may follow irradiation of the tumor laden ducts. Skin grafts applied to the inner canthus regions can extend out onto the surface of the eyelids with good functional and cosmetic results.

In the ala nasi regions excisions of varying depths are made, depending upon the depth of the lesion. Full thickness involvement of the nasal alae may require the use of a composite graft or a pedicle flap. The defects of lesser depth can be resurfaced with full thickness skin grafts. Appropriate creases can be made in such cases by incising the graft at the site desired at the time of its application.

Primary surgical excision is of great value in lesions involving the vermilion surface of the lip, whether benign, premalignant or malignant. One often encounters nonhealing ulcerations of the lower lip which have been treated by

many varieties of salve or cream. After 3 to 4 weeks the edges become scarred, indurated, and healing is prohibited. A biopsy specimen of such lesion may show an absence of malignancy yet the lesion remains unhealed. Transverse elliptical excision obtains both diagnosis and healing at once. The excision may include the entire vermilion surface, requiring advancement of the mucosa to the skin edge to form a new vermilion surface. This method is useful also in the treatment of hyperkeratotic or leukoplakic areas of the lower lip, and can be extended to include the more superficial carcinomas of the lip, especially those of considerable width across the lip. While "V" excision probably is the most commonly used surgical method of treatment of carcinoma of the lip, its use becomes limited when the width of the lesion exceeds one third of that of the entire lip, or more than 2 centimeters. With careful technic, extending well



(a)



(b)

FIG. 3. (a) Superficial carcinoma of lower lip which developed in old scar over a wide area. (b) Removed by transverse elliptical excision extending well into muscle. Mucosa advanced forward to skin.

into muscle, the transverse elliptical approach can produce adequate excision with satisfactory appearance (fig. 3). The carcinomas with deeper extension and induration, whose widths are too great for "V" removal, may be treated with radiotherapy. Otherwise they may be widely excised and repair accomplished by shifting of flaps from the other lip.

Superficial leukoplakic areas on the oral mucosa, palate and gingivae are satisfactorily removed by lifting off sheets of involved mucosa with an actual cautery, and the procedure is more effective than mere superficial baking of the surface. Benign papillomas, fibromas, ulcers, granulomas, cysts, and the like are usually amenable to excision and primary closure. Defects too extensive for closure may be grafted or allowed to epithelialize over a scar base.

Primary malignant surface lesions of the oral cavity may be removed surgically or treated with radiotherapy. Lesions overlying or involving bone, such as those of the hard palate or gingivae, may be spared complications of osteitis or sequestration by primary surgical removal. Such removal is accurately and adequately accomplished by the use of the scalpel and osteotome rather than

with the electric cautery (fig. 4). Electrocoagulation may be useful in certain instances for the control of bleeding after the biopsy specimen is removed.

The external ear lends itself nicely to surgical excision of surface lesions. The use of the cautery or irradiation sometimes damages cartilage, producing complications requiring eventual surgical corrections. Lesions on the helix are readily removed by elliptical or wedge excision. Those located on the anterior or posterior aspects of the ear, when fixed to cartilage, are treated by full thickness through and through removal of the involved portion of the ear. Plastic revision of the ear is done at the time of removal of the lesion. Better healing is obtained by careful skin to skin closure both anteriorly and posteriorly, and by trimming back a suitable margin of cartilage to afford easy skin apposition rather than by suturing through the full thickness of the ear. Besides keratoses and epi-



FIG. 4. (a) Epidermoid carcinoma of mucosa of hard palate. (b) Excised *en bloc* with underlying bone. Defect healed in promptly, resurfaced with scar epithelium.

theliomas, a fairly common surface lesion of the ear is the *painful nodule*. These benign nonulcerated bulbous swellings commonly are located on the edge of the superior portion of the helix. Their chronic inflammatory reaction involves the dermis and often the underlying cartilage. The patient cannot tolerate the pressure of a pillow at night. These lesions frequently follow the use of escharotics or cauterization of superficial keratoses of the ear. They are conveniently removed by surgical excision. Lesions on the portion of the ear near the scalp are excised and closed by *pin-back* procedures. More extensive superficially excised areas are resurfaced by free skin grafts, while complete removal of large portions of the ear requires planned staged reconstructive procedures.

Scalp lesions are conveniently treated by surgical methods. Superficial excisions, which are too wide for primary closure, are covered with free skin grafts. If a lesion is deep to the point of fixation, it denotes involvement at least of the pericranium, and more extensive procedures are necessary. Appropriate roentgenograms will determine any gross bone involvement. Even with negative roentgenograms one may find early superficial bone invasion while cautiously stripping off the pericranium (fig. 5). Where such roughening is noted, this area of bone (outer table) must be removed as a plate *en bloc* with

the specimen. Bare bone, which has been stripped of its periosteum, may immediately be covered with a thick split-graft to the entire bone area, and reasonable take may be expected. One must be careful to decorticate sufficiently deep to produce enough bleeding points to support the graft. Also the graft must be perforated extensively and must be sealed intimately to the bone at operation by continually pressing out blood and serum over a long period of time before applying the dressing. This method is advantageous over that of waiting for a bed of granulations to develop, in that often the entire coverage can be accomplished with a single operation and hospitalization, where multiple procedures are often necessary in the other instance due to postoperative drying. If any areas of graft are lost, further decortication and grafting is done until they are completely resurfaced. Alternate methods of shifting of scalp flaps are useful, but may not be as satisfactory in certain areas, as about the forehead or



FIG. 5. (a) Postirradiation persistence of extensive basal cell carcinoma invading outer table of skull. (b) Excised *en bloc* with outer table of skull, with immediate grafting on bone with 100 per cent take.

temples. Extensive cauterization to produce sequestration is more prone to lead to complications and long term procedures to bring about eventual coverage. Deeper bone invasion, as shown on roentgenograms, may require removal of the entire thickness of the calvarium. Closure of these defects requires the use of metallic plates with shifting of flaps for coverage, or free grafting of a properly granulated dura.

Postirradiation recurrences of surface malignant tumors are best treated by operation. Reirradiation may result only in tissue damage without eventual eradication of the tumor. Irradiation recurrences require more extensive surgical treatment due to the development of scar tissue in the area and a jeopardized blood supply. Excisions must extend out into healthy tissues to obtain adequate healing. Such defects may be covered with free skin grafts but occasionally repeated grafting is necessary for final complete coverage. Tissue flaps are generally adequate on first application (fig. 6).

Carcinomas developing in previously irradiated areas are of the epidermoid type and respond to surgical excision. Not only must the tumor area be excised

but also the entire irradiated area so that suitable resurfacing can be done. In certain instances about the neck region delayed grafting is useful, allowing granulations to develop and the tissues to become relatively stable and immobilized before grafting is done (fig. 7). This usually can be accomplished in



FIG. 6. (a) Post irradiation (radium) persistence of basal cell carcinoma extending through full thickness of cheek. (b) Wide excision, with downward (180°) rotation of cheek flap (all layers) at single operation.



FIG. 7. (a) Epidermoid carcinoma originating in previously irradiated area. Patient was treated with roentgen rays for goitre 25 years ago. (b) Defect was allowed to granulate and stabilize for 10 days. Skin graft was then applied.

one period of hospitalization, and is less time consuming than the staging and application of tissue flaps.

SUMMARY

Indications for primary surgical excision of benign and malignant surface lesions of the head and neck are presented. Haphazard treatment of lesions which have not been subjected to biopsy study, with escharotics, pastes, and

electric needles is condemned. Pigmented lesions are best removed with the scalpel. Careful excision and grafting permits surgical removal in less accessible areas, with good cosmetic results. Transverse elliptical excision is used to remove nonhealing ulcers, premalignant lesions, and some superficial malignant lesions of the lip. Malignant scalp lesions involving the pericranium and bone are excised, with immediate skin grafting. Postirradiation recurrences are treated by operation. Carcinomas developing in irradiated areas are widely excised, with immediate or staged plastic repair.

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THE CONSERVATIVE TREATMENT OF HYDRONEPHROSIS

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Dilatation of the renal pelvis and calices caused by obstruction to the outflow of urine, is called hydronephrosis. Such a condition is produced by progressive dilatation of the kidney pelvis due to increased intrarenal pressure. Unless the condition is corrected, the kidney will be completely destroyed. If the obstruction is removed and the renal damage is not too great, it is surprising to what extent the kidney will recover. The dilatation occurs above the point of obstruction. If the obstruction is at the uretero-pelvic junction, only the pelvis will be dilated. If the obstruction is in the ureter, the ureter will be dilated above that point. If the obstruction is at the ureterovesical junction, the whole ureter will first be dilated followed by dilatation of the pelvis. If there is a long-standing bladder neck obstruction, as in congenital valve cases, it will result in bilateral uretero-hydronephrosis.

The conservative management of uretero-pelvic obstruction is emphasized. Normally, the ureter is narrowest at this point except at the ureterovesical junction. Henline states, that in 2 per cent of all people this narrowing at the uretero-pelvic junction is excessive so that an actual stricture is present, and that this narrowing is the cause of most cases of hydronephrosis. Obstruction may be caused by bands of fibrous tissue or an aberrant artery. The obstruction causes constantly increased pressure in the renal pelvis, although there is drainage of urine from the kidney. This results in a dilatation of the pelvis and the calices with a resulting thinning out and destruction of the cortex so that eventually the kidney becomes a thin walled sac, filled with watery urine and the kidney loses its function. The normal uretero-pelvic junction is at the most dependent part of the pelvis, but as the pelvis dilates, stretching occurs to the inner side, so that the ureter rides higher and higher upon the side of the pelvis.

The normal capacity of the pelvis averages 6 cc. A kidney which holds 10 cc. of fluid may be considered an early case of hydronephrosis. As the function of such a kidney decreases, the other kidney does more and more work and a compensatory hypertrophy occurs, and the hypertrophied kidney will appear larger on a roentgenogram. It may take many years for a kidney to be destroyed but if the stagnant urine becomes infected, destruction progresses faster.

In a thorough examination, routine intravenous urograms are made so that many cases of hydronephrosis are found which are symptomless. As the renal and gastrointestinal sympathetic nerves are closely associated, many cases give symptoms of indigestion. There may be attacks of renal colic and in between these, a constant dull ache on the affected side, which interferes with and is made worse by activity. Sometimes the large pelvis will be over-filled so that

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the kidney can be palpated. There may be a constant sense of fullness on the affected side. In infected cases, there are recurrent attacks of chills and fever. Bladder symptoms may be present when there is infection. Hydronephrosis is often congenital and bilateral. Judgment is all important in these cases. If possible, both kidneys should be saved.

Urological surgery is becoming more and more conservative and, by proper plastic operations, kidneys which previously would have been removed are now saved. By a thorough urological examination, we can determine fairly accurately the condition of each kidney, so that one can decide what needs to be done at operation. When a kidney is badly damaged, and compensatory hypertrophy has already taken place in the other, the damaged kidney should be removed. Until the past few years, even when kidneys were worth saving, plastic operations were often so unsuccessful that secondary nephrectomy was necessary.

Intravenous pyelograms show a delayed excretion of the contrast medium and dilatation of the pelves and calices in hydronephrosis. In the one and two hour roentgenograms, contrast medium will still be present, thus proving poor excretion. Cystoscopy and ureteral catheterization are done. Specimens are collected for culture, and a differential functional test, and retrograde pyelograms are made. The size of the pelvis can be judged by the quantity of residual urine that can be withdrawn. A second roentgenogram is made 10 minutes after the first and if there is still contrast medium in the kidney, it indicates poor drainage, as normally all urine will drain into the bladder by that time.

Dilatation of the uretero-pelvic junction with ureteral catheters is worthless. The treatment of hydronephrosis is surgical. Many cases due to obstruction by fibrous bands or aberrant arteries, are cured by simply severing the arteries or bands and thoroughly freeing the adhesions around the uretero-pelvic junction, followed by suspension of the kidney. As the junction of the stomach and duodenum is somewhat analogous to the uretero-pelvic junction it is natural that methods used to relieve obstruction at the pylorus, such as the Finney operation and many others, should have been tried at the uretero-pelvic junction. However, all of these operations left the opening, although large enough, up on the side of the pelvis so that drainage was still defective. Foley² invented the bulb catheter, and evolved an operation whereby the opening would not only be large, but it would be at the most dependent portion of the pelvis, thus establishing good drainage. Briefly, he did his operation by incising the ureter on its outer aspect, which faces the lower pole of the kidney for a distance of 2 cm. below the pelvis and extended the incision in the form of a "V" on the under surface of the pelvis. The tip of the "V" was sutured into the lower angle of the ureteral incision, thus making the new uretero-pelvic junction 2 cm. down the ureter, at the most dependent portion of the pelvis. The edges were brought together after splinting the ureter with a no. 12F catheter and inserting a nephrostomy tube. It is important that the uretero-pelvic junction be thoroughly freed up and all adhesions removed and that the ureter be freed well down to the pelvic brim. In replacing the kidney, it should be put well up under the rib and with no kinking at the uretero-pelvic junction.

D. M. Davis,¹ by careful animal experimentation, has proved that, if the ureter is split and then splinted on an ordinary no. 12F catheter for a certain length of time, it will regenerate in the larger caliber. He has applied his ureteral intubation operation successfully in selected cases. This operation can be a life-saving procedure in cases where the Foley Y plastic operation is not suitable. I have used the Davis method successfully in 2 cases and the Foley operation in 11 cases. In 7 of these cases there was no other choice because the other kidney was functionless. The results were successful in all. In no case was the pelvis resected, although several were quite large. The pelvis contracted down well after the obstructions were relieved, as the first and last pyelograms showed. The following are illustrative cases.

CASE REPORTS

Case 1. Mrs. G. R. G., aged 46, was first seen in September 1946. Twenty years before she had had the right kidney removed. For 17 years she had known there was a large stag-horn stone in the left kidney and a silent one on the right ureter. Her urine had been loaded with pus and mucus. She had had pain occasionally in the left kidney, accompanied by fever. The pain had been constant and almost unbearable for the past two months, during which time she lost 15 pounds. Urological examination showed a stone in the right ureter and a large staghorn stone in the left kidney. The urine was loaded with pus and mucus and a culture showed *B. proteus*. On Oct. 2, 1946, a left nephrolithotomy was done. Convalescence was stormy and the incision finally closed on December 10. Her condition was good until July 1948, when she began to lose weight until she weighed only 90 pounds. Her urine was foul and examination revealed a large stone in an upper calyx and the lower pelvis was filled with a stone. The pyelogram showed a stricture at the ureter-pelvic junction. At operation, Sept. 18, 1948, the lower half of the kidney was found to be destroyed. The stones were removed and a Davis intubation ureterotomy was done, which was made difficult by the previous operation. Her condition was extremely serious for more than two months, but finally she began to eat well and gained strength and weight. At the present time, (1952) she feels well and weighs 130 pounds. Repeated roentgenograms show no stones, and the upper, and only calices, are draining well. Her urine has persistent pus but no odor and is acid.

Case 2. Mrs. J. S. L., aged 23, was first seen on Jan. 5, 1951. For three years she had at times had blood in her urine. She has three children and with the last pregnancy, she was very ill with chills, fever, and pain in her left side. Urological examination revealed a right ureterocele which could not be catheterized. An obstruction was found in the left ureter and no urine was obtained from that kidney. Intravenous urograms showed a large non-functioning left kidney with many small stones. There was a considerable right hydronephrosis and hydro-ureter and a small stone in the right kidney. The right ureterocele was slit on Jan. 14, 1951, and on January 21, a Foley Y plasty was done on the right kidney. On February 17, a left nephrectomy was done and the kidney was found to be completely destroyed leaving only a hydronephrotic sac. She was last seen eight months later when she felt fine and had completely regained her strength. A right pyelogram showed a large pelvis of normal shape with slight blunting of the calices and a normal uretero-pelvic junction.

Case 3. Mrs. E. C. C., aged 47, was first seen on April 4, 1951. She had four children and her uterus had been removed four years before. She had complained of pain in the right kidney region for years and this had been much worse in the past six weeks. The right kidney was palpable and enlarged. Urologic examination revealed an obstruction 3

cm. up the left ureter which could not be passed. No urine was excreted from this side. From the right kidney, 100 cc. of residual urine was drawn. The right pyelogram showed a greatly dilated pelvis and calices, but considerable kidney substance. Intravenous urograms showed no function on the left side and a dilated pelvis showing faintly on the right side. On May 3, 1951, a Foley Y plasty was done on the right kidney. Her convalescence was uneventful. When last seen one month ago, she felt fine, was working every day and had gained 40 pounds. Her urine was negative and a pyelogram showed the kidney pelvis to be greatly reduced in size with only slight blunting of the calices, and the ureteropelvic junction appeared normal. There were only 10 cc. of residual urine.

Case 4. Leroy L., aged 22, was first seen on Aug. 1, 1951. He had had pain in the right side for six months and had been unable to work. Urologic examination showed a normal left kidney and a right hydronephrosis. On August 10, a Foley Y plasty was done on the right kidney. Convalescence was uneventful. On November 15, the pyelogram showed a greatly reduced pelvis with almost normal cupping of the calices. He felt fine, had no more pain and was working every day.

CONCLUSIONS

A properly done plastic operation will save a kidney from destruction. In a number of cases it will prove a life saving procedure, when there is only one functioning kidney.

The Davis intubation ureterotomy and the Foley Y plasty have proved satisfactory in my hands.

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UNILATERAL LOBOTOMY FOR THE TREATMENT OF INTRACTABLE ANXIETY STATES

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The new in medical progress is frequently a rediscovery of old observations. Psychosurgery, for example, began Dec. 29, 1888 in Switzerland when Burckhardt² performed a right unilateral prefrontal lobotomy with the stated objective of converting an assaultive, hostile patient into a quiet, passive, controllable person. His patient was quite psychotic, but was much *improved* after this procedure. A total of four prefrontal sections, including bilateral incisions, were done upon this poor patient, after which he was described as what may be freely translated as *satisfactorily tranquil*. For some reason this new field of surgery was not popular for a long time and it was not until 1935 that Moniz³ and Lima, working from a sound scientific standpoint, applied bilateral prefrontal lobotomy to clinical problems. Freeman and Watts⁵, in this country, applied this procedure widely, and it is their work which probably was most effective in publicizing this addition to the therapeutic methods of neurosurgery.

Like many new clinical procedures, bilateral prefrontal lobotomy has been widely applied. That it is too widely applied appears to us to be suggested by initial glowing reports which have later calmed down to reasonable clinical perspective. The indications for the application of bilateral prefrontal lobotomy are often only to be classified as *in desperation*. Wilson,¹² for instance, stated, in the past year, that "the main reason for doing this operation is that it usually works". Such empirical clinical reasoning is not unsound but it is not conducive to an understanding of either the possibilities or the limitations of this procedure. Lyster⁸ observed that "prefrontal lobotomy relieves symptoms found in affective psychoses, such as severe mental depression, agitation, restlessness, suicidal tendency, nervous tension state, anxiety and apprehension". Clark¹ studied the available data from experimental and clinical material, after which he formulated a practical and firm anatomical concept of the more important connections of the frontal lobes. In brief he observed that the connections of the frontal lobes with the thalamus and hypothalamus were intimately bound in two-way connections with frontal cortical projections of thalamic nuclei and hence the hypothalamus. Frontal lobe cortical activity, therefore, is reflected in

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thalamic and hypothalamic discharges. Similarly hypothalamic and thalamic activity is reflected in frontal lobe cortical activity. It should be noted, of course, that the frontal lobe cortex is similarly interconnected with cortical areas in other portions of the brain.

Bianchi¹ has reported that unilateral destruction of a frontal lobe resulted in only slight changes in the neurophysiologic state and behavior pattern in contrast to the marked changes he observed with bilateral frontal lobe removal. Feuchtwanger⁴, Goldstein⁶ and Kleist⁷ observed that *unilateral frontal lobectomy produced marked neurophysiological and behavior changes*. Rylander¹¹ studied the postoperative changes of unilateral lobotomy cases, reporting less change than he observed in bilateral cases. All of these observers noted that there was uniformly a definite decrease in the psychomotor tension in the unilateral cases.

Our report is based upon a study which was suggested to one of us (E. H. P.) by Dr. Henry G. Schwartz after he observed that prefrontal lobotomy patients, (all of whom were psychotic and operated upon under local anaesthesia), reported spontaneously as he sectioned the first mesial fronto-thalamic and thalamo-frontal bundle a marked relief from *tension* or *inner tightness*. Schwartz observed that section of the remaining bundle on the opposite side produced no further subjective relief to the patient on the operating table.

The symptoms of *tension*, *inner tightness*, *anxiety*, *fear without reason*, with biological reflections in *spastic gut*, *colitis*, *palpitation*, *tight chest* and the like, confront the practicing neuropsychiatrist almost constantly. In some cases depression overlies the anxiety to such a degree that suicide is a serious threat. In other cases the very tension itself is so acutely painful and so intractable that suicide is preferred by the patient. Alcohol is found by some to produce temporary relief and, in the susceptible, addiction may complicate the syndrome. The multiplicity of therapeutic approaches advocated attest to the validity of the term *intractable anxiety*. Electroshock almost uniformly clears the depression, if this be present, but the anxiety and increased psychomotor tension either remains or quickly reappears when the postshock confusion clears. In acute cases the subcoma insulin treatment was found of value but the chronic cases remained chronic with this therapy in many instances. Psychotherapy of a variety of technics has value in some cases, but even the most narrowly oriented psychotherapist finds the chronically anxious, tense, anorrexia, insomniac, self-centered, somatic-preoccupied anxiety neurosis still intractable, often after years of intensive therapy. The description of such patients as masochistic is of interest but is not therapeutically helpful. Such patients are not psychotic. They are totally disabled. The syndrome threatens life both because of suicidal tendencies, and often because of malnutrition and secondary avitaminosis. Intercurrent infections produced death in many of these cases prior to the advent of antibiotics and sulfa derivatives. Formerly many patients had multiple laparotomies in search of the origin of the *tight gut*. Because of the severity of the symptoms, the seriousness of the danger to the patient's life, and the chronicity of the syndrome, with its resultant economic drain upon the family

resources in each case, we believed that the resort to drastic measures was warranted. Our experience with bilateral prefrontal lobotomy, however, made us unwilling to accept the risk of converting any nonpsychotic patient into a passive, vegetative level.

Our selection of unilateral prefrontal lobotomy was, therefore, with the objective of changing the neurophysiological responses of the body to stress or tension, reducing, but not eliminating, psychomotor tension. We hoped that concomitantly there would be less self-centered somatic preoccupation and hence more possibility of re-education of behavior patterns—psychotherapy in practical terms. It appeared possible that somatic stimuli would have less cortical reflection and be less disturbing to the patient. We selected the right side in our unilateral approach because this side is usually the nondominant hemisphere.

On March 5, 1951, the first patient of this series was operated upon. He met the criteria of the syndrome, as we have indicated above, in every way. In addition he was 69 years old, adding some organic hazards to the prognosis. He had been totally disabled for 15 years and was a *graduate* of 12 hospitals and sanatoriums. He had received electroshock, insulin sub-coma, insulin shock, psychoanalysis, several varieties of psychotherapy, occupational therapy, recreational therapy, travel, changes in environment and several minor therapeutic efforts by bath enthusiasts, osteopaths and chiropractors. In the course of these years his entire rather large personal fortune was expended. His domestic situation deteriorated markedly. His chief complaint was "my bowel is so tight, it cramps and hurts, it's what makes me nervous. I can't get anybody to operate on it but I can't stand it any longer. My God, my God, do something—I'm going crazy". Our recommendation of a right unilateral prefrontal lobotomy was based upon the scientific data which we have reviewed above and was qualified by our agreement to have the left side operated upon later if the first procedure was found to be inadequate. The recommendation was accepted by the family and by the patient *in desperation*. Fortunately, the immediate postoperative results were dramatically good. Our patient immediately felt calm, began to eat, sleep, walk, play cards, go fishing and since has been busy, active, happy and comfortable. Monthly follow-ups have been uniformly excellent. The only criticism we have had has been from his wife who complains that it took 15 years and a fortune for someone to think of a single little operation to cure him. Fortunately she has a sense of humor.

We have had more than 50 patients with this syndrome in which we have utilized unilateral prefrontal lobotomy. Of the first 50 such cases, only 1 has been a complete failure. This is a case in which, in retrospect, we believe we failed to recognize the schizophrenic thinking under the severe anxiety and depression which were the precipitating and most evident symptoms. This patient is much more comfortable, has gained weight, eats and sleeps well, but is inert, unimaginative and hostile to his family. His not too unreasonable reaction to their insistence upon his return to his professional practice is that

from it he received only fatigue, headaches, money and a nervous breakdown. He sees no point in merely getting back on the treadmill to satisfy their economic needs. He is comfortable.

The average length of time in the hospital postoperatively has been 10 days. This postoperative time has varied from 5 to 21 days. No operative complications have been met. With the one exception, given above, every patient in this group has returned to his previous economic and social activities. One physician-patient in this series returned to his practice five months postoperatively, after four years of illness, during which time he was impoverished, divorced and lost the custody of his only child.

The uniform results of this procedure have been to decrease the psychomotor tension and allay the subjective anxiety of these patients. In none has there been impairment in memory, intellectual functioning or judgment. All have regained appetite, gained weight, and normal sleep rhythm has been restored. In 10 cases (20 per cent of the series here reported) there has been some complaint of decrease in pleasure sense or enjoyment. In each of these cases there is the added comment, "but this is so much better than being like I was before". Initiative has been decreased in one half of this series of cases. In only 1 case has this been severe, but in others it is observed by both the patient and the family as being evident in work, social activities and interpersonal relationships. These patients, with the 1 exception, have, in six months, regained initiative and are considered by their families and themselves to be *almost normal* in this respect. One patient, a professional artist, received better newspaper reviews of her work postoperatively than she did preoperatively. We were unable to detect any difference.

We have done the standard classical lobotomy, using the method described by Poppen. We remove a button of bone with a trephine and then, under direct vision, section the brain down to the grey matter just anterior to the tip of the lateral ventricle. The white matter is sectioned completely under direct vision, with especial care taken to sever all the fibers that lie orbital to the tip of the anterior horn of the lateral ventricle. We believe that this procedure can be done accurately and safely only under direct vision. Not only is it particularly important in these patients that all the white matter be sectioned, but it is further imperative that hemorrhage and widespread tissue destruction be avoided. The surgical objective has been the modification of a neurophysiological state—not the destruction of brain tissue. The time honored dictum of good surgery, gentleness and care of living tissues, is certainly as true in the central nervous system as in the peritoneal cavity. A definite limited area has been sectioned. Brain tissue is too valuable a substance to be thoughtlessly and needlessly destroyed. We have used the open surgical procedure routinely, because we know of no *blind* technic which accurately selects the fibers we desire sectioned, and spares all of the other tissues. In none of these cases has there been infection or hemorrhage.

SUMMARY

In summary, section of the fronto-thalamic and thalamo-frontal pathways in the right hemisphere by unilateral prefrontal lobotomy decreases the intensity of impulses from the frontal lobe to the hypothalamus and from the hypothalamus to the frontal lobe. Clinically the application of this surgical procedure decreases the biologic components of severe anxiety states not previously amenable to any of the various more conservative therapeutic approaches. The subjective relief of anxiety, apprehension, fear and often depression seen in cases of intractable anxiety is relieved by this operative measure. In our experience no complications have been encountered. Memory, intelligence and judgment have not been altered by this procedure in our patients. No patient has had urinary incontinence. Fifty cases of intractable anxiety have been observed from 6 to 18 months postoperatively, during which time no relapses have been observed. All of the patients here reported had received multiple conservative treatments prior to operation and all had either relapsed shortly after treatment or had failed to respond to the less drastic measures. The duration of illness preoperatively in the cases here reported was from 1 to 15 years. None was psychotic. All were private patients.

We have utilized unilateral prefrontal lobotomy as a neurosurgical means of altering a severe chronically impaired neurophysiological and behavior status in which there were subjective emotional components of anxiety, often with an overlay of depression. We have evaluated the patients in the series of 50 here presented in terms of the desirability of such an alteration of the neurophysiological mechanism rather than in terms of definitive treatment of a specific diagnostic entity. We believe that evaluation of patients by these concepts, without reference to forced and often artificial diagnostic categories, will, in the future, permit the earlier exhibition of this procedure with resultant shortening of illness, avoidance of complications and preservation of the patient's economic and social status. The careful selection of patients for this procedure is, in our experience, the key to the prognosis. We are unable to accept any of the blind surgical techniques.

Russell¹⁰ has concluded, after studying the effects of brain injuries, that "the evidence suggests that we have all used our prefrontal lobes to a great extent in the past to build up our own peculiar way of thought and life, and to exploit our emotional capacity to provide the necessary drive to work. Most of us can still use them to enable us to work long hours, to change our habits, and to plow along untrodden paths. In our later years it is easier to travel in the well worn paths of thought and behavior, so if our mental conflicts become intolerable we may then gain something by having our prefrontal lobes destroyed". Perhaps the results of our work may be summarized in Russell's language as *partially destroying* the prefrontal lobe effect upon the patient.

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DISCUSSION: W. B. WEARY, M.D., DALLAS, TEXAS

The paper given by Dr. Woolsey and Dr. Parsons and their co-workers on unilateral lobotomy in the treatment of intractable anxiety states once again opens the discussion of all the innumerable problems that arise whenever investigators make a new surgical attack on the human frontal lobe.

Dr. Lyerly reported in 1941 the use of unilateral lobotomy in cases of psychoses with variable results. Later, there were several other reports of single cases to suggest that the unilateral procedure was not without value.

The unilateral approach for treatment of the intractable anxiety state is of course highly reminiscent of the work initiated by Dr. Scarff on unilateral lobotomy for treatment of intractable pain. Surgeons performing this procedure in pain problems are immediately aware of the disappearance of the associated anxiety state and the frequent occurrence of euphoria. These observations and the above isolated reports of the unilateral approach would be sufficient for the authors to believe it worthwhile to embark on their present problem dealing with the anxiety states.

As so many of us have found in lobotomies for the relief of intractable pain by the unilateral procedure, after a period of six months or more, it becomes necessary to perform the operation on the opposite side. Accordingly, one wonders if the time element has been long enough to obtain a fairly accurate picture of the results obtained by the authors. We all would like to see the follow-up reports of these cases, and if and when relapses occur.

Concerning the problems of the human frontal lobe or of the mind-matter philosophy, we all know that there will be conflicting feelings and opinions about performing the unilateral surgical procedure in treatment of the cases of severe chronic anxiety neuroses, since various groups believe that they obtain sufficient results with either psychotherapy or with electric-shock treatment. Since these conflicts are sure to arise, do not the authors believe that they too will have to set up a standard or base line of approximate time limitation as to employment of the conservative measures before offering surgical intervention, in the same manner as was done for lobotomies in cases of psychoses? I know this may defeat their purpose as to saving of time and expense for the patient, but it would allow all groups, including the family physician, the psychiatrist,

and the neurosurgeon to participate in stabilizing or standardizing this valuable surgical approach by determining upon whom and when to operate.

Personally, I have had no experience with the unilateral lobotomy for the chronic anxiety neuroses solely. My own very limited experience with the problem was in performing section of the mesial quadrant bilaterally. On observing these patients later, one noted that they still experienced mental conflicts, but without the emotional overlay or the vasomotor and sweating responses. My observations of these few cases have been like those of others reported; that though the anxiety state was relieved, the patient was further disabled by loss of the so-called frontal lobe functions.

As with all the other surgical methods, this brings up the problem of unilateral or bilateral procedures. The authors here have as support for their procedure, the findings of other workers, that unilateral procedures upon the frontal lobes fail to reveal any impairment of intelligence tests or tests of higher intellectual functions both in human beings and in animal studies. But other investigations, such as that by Dr. Ward Halsted and his workers on impairment of cerebral function resulting from cerebral injuries of various types, show that there is a rather high impairment index, if I recall correctly, for frontal lobectomies, whether the lesion is unilateral or bilateral, and whether on the left side or right side of the brain. The workers of the Columbia Graystone Project report, in their early observations, that the removal of the cortical tissue bilaterally by topectomy did not result in any alteration of intellectual function by tests devised up to date.

Since the transorbital approach bilaterally has been done for the chronic anxiety state, would the authors consider that the unilateral transorbital approach might yet be more time saving and more economical to the patient than the unilateral lobotomy? I do not employ this method myself for various reasons, but I am sure this question will arise.

DISCUSSION: E. H. PARSONS, M.D., ST. LOUIS, MO.

Dr. Weary has pointed to the defect, which my associates and I believe is most evident in our present presentation: that the length of time which these patients have been observed is not as long as we would like to draw final conclusions. We are attempting to present, however, a reasonable number of patients observed more than six months postoperatively. We have operated upon more patients than are reported here, but have, for the purpose of this study, limited our survey to those with not less than a six months postoperative follow-up. I realize that this is not enough, and we shall make subsequent reports. To date we have observed no relapses.

The second point which Dr. Weary raises is that of criteria for the use of this surgical intervention, which criteria we did not delineate in this study. I assure you that such criteria are important, for it is not our intent to suggest that the procedure of unilateral prefrontal lobotomy is to be considered lightly. Time does not permit a presentation of the present concepts of the criteria for the advocacy of this procedure. I assure you that a study in this connection is in

process, and with your permission we would like to report on this later, because I'm not sure at the moment exactly what the criteria should be. I am sure that many of the patients whom we have here reported could have been saved years of suffering, and a great deal of time and money would not have been wasted had this procedure been utilized earlier.

Dr. Weary asked that we comment on the transorbital surgical approach. Unfortunately, I cannot do so since we have not used this approach in any of these cases, nor have we used the so-called blind operation in any of our patients. I believe that I present the views of the surgical member of this group, Dr. Woolsey, when I state that we are unwilling to utilize the blind operative procedure, since we have adequate surgical facilities available, and our patients are handled in modern metropolitan hospitals in a large medical center where such a short-cut procedure has little to offer. No reason has been evident to us that we should subject our patients to the risks inherent in such blind operative measures.

MANAGEMENT OF COMMON ANORECTAL CONDITIONS WITH SPECIAL EMPHASIS ON PREVENTION OF PAIN

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The patient with an anorectal condition requiring treatment is apprehensive if not actually afraid and anything that will reduce or prevent his pain is greatly appreciated. One should not fail to spend sufficient time with patients before examination or operation to reassure them and explain to them that much of the pain in the anal region is caused by spasm of the sphincter muscles. They can also be told that they will have relief from pain or discomfort in the same degree that they are able to accomplish relaxation of the sphincters. When the patient cannot relax, less painful examinations can be made if an anesthetic lubricating jelly is used. A satisfactory anesthetic of this type is 5 per cent intracaine in a lubricating jelly. In patients with a tight or spastic sphincter, the little finger instead of the index finger should be used for doing the digital examination. Examination of fistulous tracts can be done painlessly if one will inject the tract with 2½ per cent intracaine solution by using a medicine dropper with a round bulb end instead of a sharp tip. A small cotton tipped applicator should be dipped in the same solution and placed in the tract for 5 to 10 minutes before passing a probe.

External Thrombotic Hemorrhoids. External thrombotic hemorrhoids are common. If the patient is seen the first day or two after the clot forms and becomes firm much discomfort can be spared him. The lesion should be washed gently with soap and water, using cotton rather than gauze to wipe the area. No shaving should be done. The region may be washed with zephiran chloride solution, 1 to 1000 strength. One prick with a small hypodermic needle is all that is necessary to anesthetize the mass with procaine solution. An elliptical incision is made over the hemorrhoid and the clot is removed completely. The bleeding point and cut edges are then desiccated with a uniterminal electric needle such as a hyfrecator, and an anesthetic ointment, such as surfacaine, is applied on a pledget of cotton. Usually no further ointment dressings are used, since in a draining wound such as this, there is quicker healing and less discomfort if wet dressings are used. My preference is to have the patient cleanse the wound several times a day with 1 to 1000 zephiran solution and apply a small, moist sponge or piece of cotton to the anus, changing the sponge when it is uncomfortable or when it drops off. If one does not have the hyfrecator, he may touch the skin edges lightly with fuming nitric acid with equally good pain control.²

Internal and External Hemorrhoids. Much less pain and associated bladder neck spasm will follow operations for removal of hemorrhoids if the bleeding is

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controlled with an electro-coagulating needle rather than by tying the bleeding vessels. The need for postoperative catheterizations, will be much less. If the skin edges are not desiccated they should be touched lightly with nitric acid for pain prevention. Another procedure to lessen pain following hemorrhoidectomy, is the practice of having the patient sit in a tub of warm water for 20 to 30 minutes several times daily beginning the day following operation. If this plan is followed, the patient will require many less hypodermics for pain and may not require any at all. It is not unusual for my patients to require no narcotics following hemorrhoidectomy, but morphine may be given when they have pain that disturbs their rest. Soaking in a tub of hot water is soothing and relaxing and nearly all patients find it of much value during their convalescence.

Postoperative gas pains can be prevented in most patients by disturbing the bowels as little as possible prior to surgery and by feeding the patients normally and fully immediately following surgery. It is the empty bowel in which the gas forms. No enema should be given on the day of the operation. If one is given at all, it should be of small quantity, given the day before operation, using plain water. It is my usual practice to give no preoperative enemas.

A piece of gauze should be placed in the rectum at the beginning of the operation to absorb blood. This gauze is removed following operation before the patient has left the operating room. This practice will remove clots from the lower rectum which might cause discomfort. No gauze or rubber tissue should be left in the anus after operation. Hemostasis should be complete before concluding the operation so that such agents are unnecessary.

The first bowel action following operation will not be painful if one will inject a solution of 3 teaspoonsful of hydrocil or metamucil to a pint of warm water and allow it to remain until the patient has the urge for the bowels to act. A well lubricated catheter should be used to inject the solution.

Cryptitis and Papillitis. Cryptitis and papillitis are managed similarly. They both require surgical removal if they do not clear up promptly under conservative management with hot sitz baths. Treatment consists of excision of crypts or papillae, using local anesthesia, and touching the wound and skin edges with either the desiccating needle or with nitric acid. The wounds are then kept clean with zephiran solution until healing is complete.

Fissure in Ano. A fissure is an elongated slit or ulcer in the lining of the anal skin. It is characterized by paroxysmal pain usually brought on by defecation. Several methods of treatment may prove effective, but excision of the ulcer and division of the superficial bundle of fibers of the external sphincter muscle, offers practically 100 per cent cures. Division of the sphincter adds to the postoperative comfort of the patient since it lessens muscle spasm. The skin edges should be touched with nitric acid or the uniterminal current as above described. Postoperative care includes hot sitz baths. The operation may be done in the office and the patient allowed to go home for his sitz baths if he is considered to be a suitable patient for home care. Otherwise he should be hospitalized for a day or two.

Fistula in Ano. Fistula in ano usually requires the complete removal of the

tract to eradicate the condition. The tract or tracts usually pass external to the external sphincter muscle or between it and the internal sphincter so that division of the external sphincter muscle only is required. Care should be taken to divide the muscle at right angles to the direction of the muscle fibers and it should be divided in only one place in order to preserve anal continence. The after-care of the wound is very important. Packs should be removed the first time they are disturbed, which should usually be about 48 hours after operation and only rarely should they be replaced. Sitz baths are begun the day following operation and continued two to four times a day until the wound has healed. Pocketing is prevented by gently wiping the wound out to its depth as often as necessary and by irrigating the wound with 1 to 2000 zephiran solution. After a few days this becomes a painless procedure. A small wet zephiran sponge dressing is placed over the wound and changed as often as necessary to maintain comfort. A furacin dressing may be used for these wounds. Neither the zephiran nor furacin is irritating but occasionally a person is found who is allergic to furacin.

Pruritis Ani. Pruritis ani is a condition in which many factors may play a part. Volumes have been written about its management. Systemic, allergies and local causes must be considered. Hemorrhoids, fissures and fistulas are at times causes, chiefly due to their irritating discharges. It is safe to say that in a large percentage of cases, the offending agent is an irritant leaking from the anal canal. The neutralization or removal of this irritant will relieve the condition. This neutralization can be accomplished by the application of hydrolamins (an amino acid ointment made by Hydrolamins Co., Inc., Brooklyn) morning and night (Bodkin).¹

In milder cases, simple cleansing with cotton wipes rather than paper, and witch hazel applications on cotton swabs will often effect a cure. Alcohol injections, using 95 per cent strength, with a $\frac{1}{4}$ inch needle at $\frac{1}{4}$ inch intervals around the anus will cure some cases. The injections must be done under spinal caudal or general anesthesia since local anesthesia will dilute the alcohol. In severe cases, the best treatment has been an undercutting operation, usually of the clover leaf type. Oxycel or gelfoam is placed beneath the skin and left until it is absorbed. All local conditions should be attended to prior to this part of the operation and all hypertrophied skin should be trimmed away smoothly.

Polyps. Polyps require removal and fulguration of their bases. One must be careful that in fulguration he does not tent the area and burn a hole in the bowel wall. Subsequent frequent periodic examinations should be made to be sure that there is no recurrence of the growths

Anorectal Abscess. Anorectal abscesses cause great pain and discomfort. In general, the treatment consists of immediate wide incision and drainage. The incision should be anteroposterior or parallel to the anal orifice. It should be made beyond the outermost fibers of the external sphincter muscle, but as near the point of fluctuation as possible. Usually it is better to make an elliptical or triangular incision and to make it quite large to assure adequate drainage. Much after pain can be spared the patient if the abscess cavity is swabbed out

with nitric acid after opening it. Hot compresses and sitz baths will afford additional relief.

Proctalgia Fugax. This is a well defined symptom complex of obscure etiology and pathology. The pain is irregular and intermittent in character and appears to be about 2 to 3 inches above the anal outlet. It is apparently a spasm of the internal sphincter muscle. There are possibly different trigger mechanisms in different persons affected with the condition. Sexual excitement seems to cause it in some persons, and infection, vasospasm, venous stasis, allergy and other causes initiate it in others. The pain has been described as boring, gnawing, cramping, aching or expanding. It usually does not last longer than 15 to 20 minutes. Hot sitz baths, warm water enemas, firm application of pressure, and assuming various postures, such as the knee-chest position gives relief in some patients. It has been found by several observers that nitroglycerine soluble tablets, grains $\frac{1}{100}$ to $\frac{1}{200}$ stops or modifies the attacks at once.

Carcinoma. Carcinoma of the anus is mentioned here only to say that most cases require abdomino-perineal resection because of the lymphatic drainage of the anus. Lymphatics below the anorectal line drain into the inguinal chain of glands and those above this line drain into the median lumbar glands which are high and far away from the site of the lesion.

SUMMARY

1. A plea is made for the physician to spend time with the anorectal patient to reassure him and explain more about the mechanics of the pain that may be caused by his condition.

2. Some practical points regarding the lessening of pain or discomfort in examination and treatment of such common anorectal conditions as hemorrhoids, cryptitis, fissure in ano, fistula in ano, pruritis ani, polyps, anorectal abscesses, and proctalgia fugax are presented.

The use of uniterminal desiccating needle and nitric acid applications is advocated in certain conditions.

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A STAGED RESECTION FOR THE PELVIC COLON AND RECTUM WITH SECONDARY ANASTOMOSIS

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Marked obesity, extensive pelvic inflammation, or shock make it sometimes advisable to forego an anastomosis of the intrapelvic segments of the large bowel. The well known alternative method, anterior resection without anastomosis (Hartmann), is expedient but leaves the patient with a colostomy which is difficult to abolish. Surgeons are reluctant to attempt a secondary reconnection of the rectum in such cases because they anticipate additional difficulties and hazards from postoperative adhesions and shrinkage of a blind rectosigmoidal loop.

There is need for a procedure that will facilitate the eventual restoration of rectal function in cases where, for one reason or another a primary anastomosis has to be avoided. With this in mind the following technic was applied in a few selected cases:

1. An adequate resection of the sigmoid and its tributary mesocolon, with or without sacrifice of the superior hemorrhoidal vessels, was attempted.
2. The orad and aborad stumps of the remaining large bowel were each closed by ligature, suture, or a combination of both. It seemed to be immaterial which type of closure was chosen.
3. The upper blind end was then approximated to the lower blind end with the aid of long interrupted silk sutures. This reconstructed externally the continuity of the intestinal tract, but the lumen was blocked by a double diaphragm.
4. A vent for the intestinal contents was provided by a colostomy placed at a convenient, but as short as possible, distance from the diaphragms (fig. 1).

The technical steps are not new, having been devised by Halsted experimentally for a closed type of anastomosis which he called *bulkhead anastomosis*. Harvey Stone (1923) found a clinical application for this technic in fashioning a temporary ileostomy for the treatment of a case of ulcerative colitis.

Restoration of intestinal continuity was effected in Halsted's experiments immediately after linking the closed ends by sutures. To accomplish this, he introduced a guarded knife mounted on a long flexible handle through the anus and directed it so as to perforate the double diaphragm before the laparotomy was concluded. Stone did not actually report on the ileostomy closure in the single case reported by him, although he gave a general outline of his plan.

In the cases here reported it was planned to abolish the diaphragms after a prolonged postoperative interval to permit full recovery of the patient and subsidence of local tissue reactions. Perforation was to be accomplished with the

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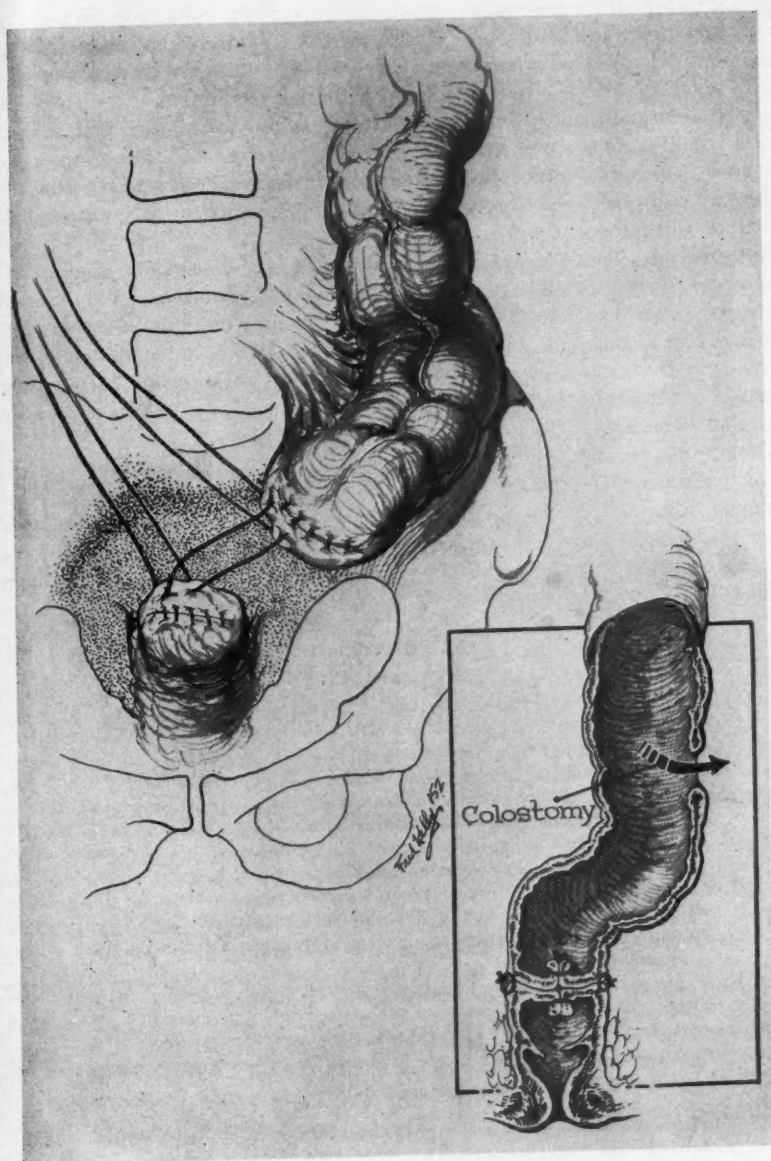


FIG. 1. Schematic sketch of operative procedure

ball shaped high frequency cutter introduced through the colostomy. In order to render this procedure safe, it was considered advisable to expose the bulkhead anastomosis by a second laparotomy. This would also afford a *second look* at the area of cancer resection. With one hand palpating the juncture, the electrode could be accurately guided from the colostomy to the obstruction, and, if accidental lateral perforation of the bowel should occur, one could take appropriate measures to prevent serious complications. With the diaphragms destroyed, the colostomy could be closed simultaneously, thus completing the surgical rehabilitation of the patient.

As described in detail, this plan was employed in 5 patients requiring low colonic resection for the followings reasons: Three had malignancies (in 1 the line of resection extended within a few centimeters of the levator ani muscle); another had a combined ileal and sigmoidal stenosis from intracavitary radiation of the uterus; and 1 patient had diverticulitis persistently suppurating notwithstanding a colostomy. In each case there were cogent reasons for avoiding an immediate suture anastomosis.

The complete procedure was necessary in only 1 case. In 4 cases nature anticipated the surgeon's intention and restored bowel continuity spontaneously. One is almost led to assume that with this technic the anastomosis completes itself automatically unless there is interference. In our case this interference may have resulted from the fibrosis and atrophy of the intestinal wall caused by radium irradiation.

CASE REPORTS

Case 1. Carcinoma in distal segment of sigmoid. Obesity.

Mrs. P., aged 52, height 60 inches and weight 224 pounds. A carcinoma with four enlarged lymph nodes adjacent, was exposed through a transverse and left oblique incision. Wedge resection, sparing the superior hemorrhoidal artery, left a short stump of rectosigmoid in the cul-de-sac poorly accessible and ensheathed in a heavy layer of fat. A primary anastomosis was considered too risky. Instead, the distal rectosigmoidal stump was closed with a two-row running catgut suture. The oral end was closed with the aid of a Furniss clamp, the catgut tie being inverted with a purse-string suture of the same material. The two intestinal ends were approximated with the aid of long interrupted silk sutures. After the approximation, the reconstructed sigmoid was too short for a loop colostomy. It was barely possible to insert it into the peritoneal suture line. A heavy gauze pack was placed over it in order to maintain a channel of access through the thick muscular and adipose layers.

On the twenty-first postoperative day, it was noticed that a colostomy irrigation was partially evacuated by rectum. A proctoscope inserted into the colostomy visualized a patent anastomosis. A barium study of the anastomosis is pictured in figure 2.

The colostomy was closed surgically at the patient's insistence seven weeks after the resection.

Case 2. Carcinoma recurrent in a colostomy. Postoperative defect of the abdominal wall.

Mrs. H., aged 63, lean, well preserved. Two years ago a Mikulicz resection of the sigmoid had been performed elsewhere, but had remained uncompleted. Recently, a fungating mass appeared in the distal opening of the sigmoidostomy. Removal of the grossly recognizable carcinoma necessitated full thickness excision of the abdominal wall in a radius of 7.5 cm. from the sigmoidostomy openings. The disk of abdominal parietes containing

the stomas, a short afferent segment of colon, and a distal loop transected a few centimeters above the cul-de-sac were resected *en bloc*.

Because of the resulting defect in the abdominal wall, a suture anastomosis was considered inadvisable. Instead, the previously described procedure was carried out with the slight variant that the stumps were closed with catgut ligatures plus inverting purse-string sutures. A diverting colostomy was placed through a separate incision in the right upper quadrant.

The closure of the abdominal cavity was precariously effected by transplanting omentum into the large defect. This tenuous layer was supported by a tamponade with multiple layers of iodoform gauze.



FIG. 2. Case 1. Appearance of anastomosis 16 months later. Previous roentgenograms no longer available, showed identical picture.

Patency of the bulkhead anastomosis was demonstrated when the distal colostomy loop was irrigated for the first time on the eighteenth postoperative day. Roentgenograms were made on the twenty-third postoperative day (fig. 3).

After pinch grafts were applied, the omental transplant epithelialized completely. The colostomy retracted after removal of the glass rod. Four months after discharge from the hospital, the patient returned to the out-patient department without even a residual fistula from the colostomy. Rectal function was normal. A repeat barium enema showed a picture essentially as before. Surprisingly the grafted defect in the abdominal wall was mechanically quite adequate. There was a slight bulge, but no definite hernia.

Case 3. Post radiation stricture of terminal ileum and sigmoid. Pelvic adhesions.

Miss A., aged 53, underweight. Patient had two preceding operations for a combined ileal and sigmoidal radiation enteritis with temporary fistulous connection between both loops. At the first operation a bypassing anastomosis between the lower ileum and ascending colon had been performed which relieved her of cramps. Six months later roentgeno-

grams revealed an advanced stenosis in the lower sigmoid and obliteration of the fistulous connection with the terminal ileum. At the second operation, persisting distention of the colon, notwithstanding prolonged preparation, prevented a resection of the involved loops. Instead a decompressing colostomy was placed in the right transverse colon. At the third operation, 15 days later, the ileal and sigmoidal segments originally found swollen and indurated to *garden hose* consistency were found to be atrophic and barely palpable in a maze of pelvic adhesions. Resection of the involved loops in en bloc was done leaving a short atrophic stump projecting through the adhesions in the cul-de-sac. The patient suffered from surgical shock which was not alleviated by blood transfusions.



FIG. 3. Case 2. Appearance of anastomosis four weeks after operation

In this case the distal stump was closed with a simple ligature of no. 0 catgut, and the upper one with Parker-Kerr technic plus a third row of interrupted catgut; the closed ends were approximated with interrupted silk sutures.

This anastomosis failed to open. Therefore, on the forty-seventh postoperative day the abdomen was re-entered through the original incision and the anastomosis exposed, the black silk sutures providing a convenient landmark. Since the colostomy in this patient was in the right upper quadrant, it was necessary to incise the colon close to the anastomosis in order to introduce the high frequency cutter. With one hand palpating the anastomosis and checking the position of the instrument, the electrode was pushed against the diaphragm in the bowel, which was opened by electrodesiccation. Due to the smallness of the bowel a lateral rent occurred at the anastomosis. Through this a small catheter was inserted as a drain. The short auxiliary incision in the descending colon was closed with two rows of sutures.

Patency of the anastomosis was demonstrated six weeks later. The transverse colostomy was closed at another hospital admission when the patient needed treatment for a fractured hip. Bowel movements and anal control returned to normal and have remained normal up to the present time, five years later.

Case 4. Diverticulitis of the sigmoid. Obesity. Incisional hernia.

Mr. H., aged 50, weight 200 pounds, height 63 inches. Originally this patient suffered from an abscess of the mesosigmoid. It was surgically drained, but a residual sinus re-



FIG. 4. Case 5. Appearance of anastomosis three months after operation

mained. Severe attacks of pain, fever and increased discharge from the sinus recurred notwithstanding a defunctionalizing colostomy in the left transverse colon which was done 18 months prior to admission. Besides obesity, there was a large incisional hernia and the sinus consequent to the first intervention. Laparotomy was done through the original incision. Most of the small intestine was contained in the underlying extensive hernia. The sigmoid was bound down by dense adhesions requiring tedious dissection by knife and blunt force. After resection, the short rectal stump was closed with interrupted catgut sutures in one row, and the proximal stump was closed with a double row Parker-Kerr stitch.

Postoperatively, a deep suppuration developed which communicated with the anastomosis. Incision of an abscess which pointed in the wound was necessary. On the fifty-second postoperative day, some time after the patient's discharge from the hospital, the

anastomosis was tested by irrigation through the transverse colostomy. It was found to be patent. The roentgenologist reported: "Examination of the distal portion of the colon from the distal colostomy opening to the anus shows communication between these points without interruption. The anastomotic site appears to function well. There is considerable diverticulosis of the remaining colon. The barium passed without hesitation from the colostomy opening to the anus." (H. R. Senturia)

Four months after resection, the colostomy, which had been present for 22 months, was closed surgically. The patient did not remain well. Two months later he had a severe recurrence of diverticulitis again necessitating a colostomy. This was done in another hospital. Apparently the resection had not been extensive enough to prevent recurrence. In addition this patient developed leukemia which took a fairly rapid course.

Case 5. Carcinoma of rectum.

Mr. F., aged 28, had a small polyp-like lesion in the anterior wall of the rectum 14 cm. from the anus. A specimen for biopsy was removed through a proctoscope. At laparotomy no involvement of the outer rectal wall nor metastases were found. A radical resection was done which included the superior hemorrhoidal vessels. Instead of completely excising the rectum it was transected 5 cm. above the levator ani muscles. The rectal stump was closed with one row of interrupted catgut sutures, and the cut end of the colon was closed with a simple catgut tie and anchored to the rectal stump with long silk sutures. The operation was complicated by bleeding from numerous small pelvic veins and from a plexus of vessels surrounding the right ureter. For drainage a rubber tube was passed through a stab wound in the perineum. The pelvis was reperitonealized, placing the anastomosis and the drain infra-peritoneally. In this case the spontaneous opening of the closed ends could be demonstrated by rectal palpation on the twelfth day. Rectal defecation returned soon after the glass rod was removed from the sigmoidostomy. Anal control became normal, and the sigmoidostomy closed except for a tiny sinus occasionally emitting gas. One year after the operation the patient refused to have this sinus closed. Figure 4 shows the roentgenographic appearance of the colon three months after operation.

COMMENT

It is generally assumed that a properly planned secondary anastomosis of the colon requires, as an intermediary step, exteriorization of the cut ends. Since this is impossible to achieve in the pelvic colon, secondary anastomosis has heretofore not played a significant part in the management of low lying lesions in this bowel segment. Yet it is in the terminal segment of the colon where primary anastomosis encounters its greatest difficulties, and where reasons for its avoidance are sometimes compelling.

It was pointed out above that with the bulkhead or blind loop technic a secondary anastomosis can be obtained easily and safely without recourse to exteriorization. This makes this method applicable to intrapelvic resections. In my experience it decreased materially the difficulties during the first stage and reduced the completion of the anastomotic connection to a minor procedure. Moreover, a second stage may not be necessary at all, because the anastomosis will establish itself spontaneously in some, and possibly in most of the cases. If this is confirmed by further experience, the operation may prove to be a very simple one.

It is gratifying to find that the blind ends have opened up, notwithstanding the fact that it is contrary to the common experience that a transected bowel is permanently sealed by ligature and suture. I have no explanation for the contrary but obliging behavior displayed when the closed ends were linked together.

It is not likely that ischemic necrosis or intraluminal pressure can explain these observations since the anastomoses were prepared in defunctionalized loops. Patency of the anastomosis was proved as early as the twelfth and as late as the fifty-sixth postoperative day, but these dates merely indicate when irrigation of the defunctionalized distal colon was tried, which was always postponed until it was considered to be without danger. It remains, therefore, unsettled whether the effacement of the obstructing diaphragms proceeds uniformly or whether it varies substantially from case to case.

While the mechanics of spontaneous anastomosis between closed loops remain unexplained, it may be of interest to report its occurrence in an additional case, not included in this series.

As far as I am aware, the use of a bulkhead anastomosis in clinical surgery was reported only once, namely by Stone. He applied its principle in making a temporary ileostomy for a patient with ulcerative colitis. The closure of the ileostomy, though contemplated, was not included in his report. Following Stone's precepts Finesilver performed, in 1927, an ileostomy with bulkhead technic in our hospital. The presumptive diagnosis, ulcerative colitis, seemed to be borne out by the improvement obtained. About one year later, the patient returned with a cul-de-sac abscess. At the second admission defecation was entirely by rectum, the ileostomy having closed spontaneously. The record did not indicate when closure had occurred. During recovery from the drainage operation an acute bowel obstruction necessitated an emergency laparotomy. A gangrenous loop of small intestine, compromised by torsion around a string like adhesion at the root of the mesentery, was removed by obstructive resection. The patient died 20 hours after operation. Autopsy disclosed that she had not had ulcerative colitis but a carcinoma of the sigmoid, not demonstrable in the original roentgenograms. The cul-de-sac abscess had been caused by necrosis of the tumor. There were no fistulous communications between the rectum and small intestine to explain the passage of stools by rectum. This permitted only one conclusion, that the diaphragm of the Stone ileostomy had effaced itself.

CONCLUSION

A method facilitating secondary anastomosis without exteriorization is described. Applied in 5 cases of difficult intrapelvic resections of low sigmoid or high rectal lesions this method was found satisfactory and technically advantageous.

The anastomosis could be readily established by a second intervention which was necessary in one case only. In the others it established itself spontaneously.

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EDITORIAL

RESECTION OR THORACOPLASTY: A LOGICAL SURGICAL CONCEPT IN THE TREATMENT OF PULMONARY TUBERCULOSIS

Since the turn of the century, great interest has been shown and greater progress has been made in the surgical treatment of pulmonary tuberculosis. Except in a few isolated instances artificial pneumothorax was the only adjunct to bed rest before 1900. Early in this century extrapleural thoracoplasty was used, and until less than 10 years ago it was the most valuable collapse procedure. Other operations were frequently used before collapse by thoracoplasty. These included phrenic nerve surgery, scaleniotomy, intercostal neurectomy, extrapleural pneumothorax, apicolysis, plombage, pneumoperitoneum, and so on.

It was because of the many failures following other procedures that resection was thought of. Less than 15 years ago resection of lung tissue carried an almost prohibitive mortality. This was greatly reduced when the individual ligation technic was applied to the hilar structures. Since then, progress has been rapid. Until recently, however, not enough cases of resection for pulmonary tuberculosis were collected and followed for a sufficient length of time to determine results.

A better understanding of what should be accomplished by the various forms of surgical therapy has been slow in establishing itself. Until the advent of streptomycin and further experience with its advantages and limitations the common multistage thoracoplasty was looked upon, and justly so, with great favor. Slowly but constantly the group of failures following thoracoplasty were increasing. These unfortunate patients were allowed to go for years with positive secretions with the hope that rest and collapse of the lesions would ultimately end in success. This false hope was maintained just as it was in those patients whose lesions became temporarily inactive following prolonged rest in a sanatorium. We now know that 30 to 35 per cent of the patients in the sanatoria are repeaters, not only once but twice, thrice, and in some instances more times.

It was found during resection that many thoracoplasty failures were due to applying the wrong operation to a specific lesion. The greatest group of failures occurred in tuberculous bronchiectasis, nodular lesions, destroyed lung, hilar cavities, lower lobe lesions, bronchostenosis, and tension cavities. The author believes that these are all indications for resection. Three hundred and twenty-five consecutive resections have been followed for from one to seven years with a conversion of secretions in over 81 per cent of the cases. One hundred and one of these were thoracoplasty failures and obviously poor risks. Notwithstanding this, the operative mortality for 325 cases (within 90 days following operation) was only 4.5 per cent.

One argument against resection has been the higher mortality. This seems to be illogical since the above mentioned cases represented a hopeless group with long-standing disease upon whom all known procedures have been tried. We are now seeing patients earlier; and with the proper use of antimicrobial therapy,

streptomycin and para-aminosalicylic acid (PAS), or with a combination of the newer iso-nicotinic-hydrazid (INH) drugs for weeks and sometimes months, large lesions seem to dissolve. Cavities fill in, and where at first it might have appeared that a whole lung would have to be sacrificed there remains only a small lesion which can be removed by segmental resection, thereby preserving lung parenchyma which would have had to be sacrificed before these drugs were known. We are no longer limited to unilateral definitive measures of collapse. Bilateral segmental resection, now being done with a negligible mortality, has a high percentage of conversions without resulting in respiratory cripples.

Resection can now be used in three forms: lobectomy, pneumonectomy, and segmental removal. Wedge resection may be added as a fourth method but is followed by as high as 25 per cent postoperative complications in the form of bronchopleural fistula, atelectasis, and postoperative hemothorax. If done at all, it would seem that it should be limited to the very superficial scattered subpleural nodules. Deep nodules should be removed by segmental dissection. Hemostasis is more easily obtained and maintained, and proper adequate bronchial closure is facilitated. The operative mortality in over 300 consecutive segmental resections is less than 1 per cent.

During the past two years we have found that it is seldom necessary to remove a lobe or lobes as often as it was before. Because of this we believe that for the first time we are making a definite and permanent reduction in the recurrence rate of tuberculosis. The newer cases entering the sanatoria are controlled by antimicrobial therapy, and after the maximum response has been obtained the dangerous residues are removed. To insure permanency in good results this therapy must be continued postoperatively as it seems to be indicated in each case.

Resection therapy is becoming more widely accepted each year as more and more cases are reported. Combined with antimicrobial therapy, it offers the best attack so far devised from a definitive therapeutic viewpoint. Refinements will undoubtedly continue to appear. We hope so. There has been a definite reduction in occupied sanatorium beds where resection therapy has been done for several years.

Is this the answer to the problem? No. We, as surgeons and physicians, are treating patients with well developed disease. The source is being sadly neglected. The various state and city Boards of Health must work as hard as the clinicians have worked. A careful examination of the sources of contact, good roentgenographic facilities, and laws compelling infectious cases to secure early treatment are essential. This will not occur and tuberculosis cannot be stamped out until the profession becomes more alert to its significance and our city and state governmental units provide adequate facilities for treatment.

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